Master's thesis

NTNU
Norwegian University of Science and Technology
Faculty of Economics and Management
Dept. of Industrial Economics and Technology
Management

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Development of a circular economy model for the leisure-related economy and investigation of potential of implementing

A case study of the leisure-related economy at Oppdal, Norway

Master's thesis in Industrial Ecology
Supervisor: John Eilif Hermansen
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Kunnskap for en bedre verden

Project description

The purpose and objective of this study is to develop a circular economy business model for the leisure-related economy and for the cottage building and to investigate the possibilities and challenges to implement circular business models in the leisure-related economy with a focus on the cottage building. The thesis explores the possibilities for the leisure-related economy to become more sustainable with regards to the economic and the environmental perspective. This is done by conducting a case-study of the leisure-related economy at Oppdal and a cottage building company in the region.

Main content:

- Introduction to the content and research questions
- Overview of relevant concepts to the study
- Develop a theoretical framework
- Develop a circular economy model for the leisure-related economy and a circular economy model for the cottage building
- Presentation of the empirical data
- Analysis of data in an environmental and economic perspective by conducting a system analysis, a SWOT analysis, and analyse the connection to the selected SDGs
- Discussion
- Conclusion and give recommendations for further study

Assignment given: January 15th 2020

Supervisor: John Eilif Hermansen

Abstract

The development of cottages and the human behaviour connected with the leisure-related economy is resource demanding and it is under a great pressure to be more sustainable (Vittersø, 2007). The development of the cottages and the lifestyle connected with this have an environmental impact and touches on a number of the sustainable development goals (SDGs). Environmental impacts may have great impact on a local level, but also on a global level. To contribute to achieve the SDGs by 2030 there need to be a rapid change in the consumption and production, and the change need to be on a local level as well as on a global level. The consumption of resources and the lifestyle on this planet is not sustainable and this is why a circular economy can be an important contribution towards a sustainable development in the leisure-related economy.

This thesis examines the sustainability in the leisure-related economy and the potential of implementing a circular economy model. The thesis developed a circular economy model for the leisure-related economy. The model is mainly based on theory about sustainability, circular economy, industrial ecology and business models. The thesis investigates a case study of the leisure-related economy at Oppdal, and for a more specific input on the cottage building, Lundhytta is investigated. The case study is being analysed using a system and comparing the case study with the developed model, the case study is also analysed by using SWOT analysis, and in the end the connection between the case study and the model with some SDGs are analysed.

The developed model for circular economy in the leisure-related economy is a simplification, thus giving the model uncertainties, but the model may have the potential of being used as a tool to guide towards a circular leisure-related economy. The trend in the analysis show an environmental and economic potential by increased sharing and implementation of sustainable design and reuse in the business models. The model indicates environmental and economic benefits from implementing a circular economy model in the leisure-related economy, but that is depended on the awareness in the market and incentives for the businesses and the community to contribute. However, to face the future challenges of limited area for cottages, minimizing the environmental impacts and biodiversity loss, the leisure-related economy needs to develop towards more environmentally friendly solutions. Implementing a CE model in the leisure-related economy may increase the potential of a sustainable leisure-related economy and to reach the SDGs by 2030. The study contributes with research on circular economy in the leisure-related economy. The research contributes with a more qualitative view than many other studies have done. The study also tries to incorporate the importance of competence and knowledge in the circular economy, which can be beneficial for future research in the field.

Sammendrag

Utviklingen av fritidsboliger og den menneskelige atferden knyttet til fritidsøkonomien er ressurskrevende og er under et stort press for å være mer bærekraftig (Vittersø, 2007). Utviklingen av fritidsboligene og livsstilen knyttet til disse gir miljøpåvirkninger og berører en rekke av bærekraftsmålene. Dette kan ha stor innvirkning på lokalt nivå, men også på globalt nivå. For å nå bærekraftsmålene innen 2030 må det skje en rask endring i forbruk og produksjon, og endringen må skje på lokalt og globalt nivå. Ressursforbruket og livsstilen i dagens samfunn er ikke bærekraftig, og det er derfor sirkulærøkonomi kan være et viktig bidrag til en bærekraftig utvikling.

Denne oppgaven undersøker bærekraften i fritidsøkonomien og potensialet av implementering av en sirkulærøkonomisk modell. I oppgaven blir en sirkulærøkonomisk modell for fritidsøkonomien utviklet. Denne modellen er hovedsakelig basert på teori om bærekraft, sirkulær økonomi, industriell økologi og forretningsmodeller. Oppgaven studerer en casestudie av fritidsøkonomi i Oppdal og studerer også Lundhytta for mer innsikt i byggingen av fritidsboliger. Casestudien analyseres ved hjelp av systemtenkning og sammenligner casestudien med modellen som er utviklet, casestudien analyseres også ved hjelp av SWOT-analyse, og til slutt blir forbindelsen mellom casestudien og modellen til bærekraftsmålene analysert.

Den utviklede modellen for sirkulærøkonomi i fritidsøkonomien er en forenkling, og gir dermed modellen usikkerheter, men modellen kan ha potensial til å bli brukt som et verktøy for å lede mot en sirkulær fritidsøkonomi. Trenden i analysen viser et potensial i økt deling og implementering av bærekraftig design og gjenbruk i forretningsmodellene. Modellen indikerer miljømessige og økonomiske fordeler ved å implementere en sirkulærøkonomisk modell i fritidsøkonomien, men det er avhengig av bevisstheten i markedet og insentiver til å bidra for virksomhetene og samfunnet. For å møte de fremtidige utfordringene som et begrenset område for fritidsboliger, arbeid med å minimere miljøbelastningen og tap av biologisk mangfold, trenger fritidsøkonomien å utvikle seg mot enda mer miljøvennlige løsninger. Implementering av en sirkulærøkonomisk modell i fritidsøkonomien kan øke potensialet for en bærekraftig fritidsøkonomi. Studien bidrar til med kunnskap om sirkulærøkonomi i fritidsøkonomien. Studien bidrar med mer kvalitativ innsikt enn mange andre studier på temaet. Studien prøver også å inkludere viktigheten av kompetanse og kunnskap i sirkulærøkonomi, noe som kan være fordelaktig for fremtidig forskning på området.

Preface

This master's thesis is written during the spring of 2020 at the Department of Industrial Economics and Technology Management at the Norwegian University of Science and Technology (NTNU). This master's thesis is the finalisation of my degree in Industrial Ecology.

I would like to thank my supervisor John Eilif Hermansen for being available for questions, giving me guidance and support during this semester. Our multiple meetings and his guidance helped me along the way to finalize the writing.

The study has been conducted under close dialogue with Nasjonalparken Næringshage. I would like to thank Erik Flå in Nasjonalparken Næringshage for providing me with insights and information, giving me connections, sharing thoughts and ideas throughout the whole time period of the study. I also want to thank Nasjonalparken Næringshage and Pir II for letting me come an observe their workshop. I wish to thank Jan Perry Lund in Lundhytta for his contributions to the study. I also want to thank Trøndelag County for getting me in tough with Nasjonalparken Næringshage.

There were no possibilities to go to Oppdal as planned, due to the corona virus situation in 2020. There was supposed to be another workshop with Nasjonalparken Næringshage and Pir II were I was supposed to observe. This workshop was supposed to be held in Oppdal and different actors from Oppdal was supposed to participate, but this was also cancelled due to the situation. The observation of the workshop could have been yet a valuable source to understand the dynamics in the leisure-related economy from different perspectives.

I would also like to thank and show my gratitude to my fellow students in Industrial Ecology, class of 2020. These two years would not have been the same without you.

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List of Concepts

Concept	Definition
Biodiversity	All living organisms, including inter alia, terrestrial, marine and other aquatic ecosystems and the ecological system that they are part of. Biodiversity includes diversity within species and between species (IPCC, 2018, UN, 1992).
Circular Economy	A system that seeks to rebuild capital, whether this is financial, manufactured, human, social or natural (Ellen MacArthur Foundation, 2017a).
Cottage	A housing where people do not have a permanent residence, but it is used for recreational purposes, relaxation and leisure activities. The cottage can be of different standards. Cottages are not depended on size, location or the season of the year it is used (The Norwegian Tax Administration, 2019).
Environmental Aspects	The elements of an organisation where activities or products interacts or can interact with the environment (Standard Norge, 2015)
Environmental Impact	A change to the environment. The change can be beneficial or adverse and wholly or partially resulting from an organisation's environmental aspects (Standard Norge, 2015)
Indicator	A tool to help measure. It can provide information of a phenomena.
Leisure-related economy	The economy regarding the cottage and the activities in the area of the cottage. This includes the money spent on a cottage, the transportation and the money they use when staying at the cottage.
Sustainability	The process that guarantees the persistence of natural and human systems in an equitable manner (IPCC, 2018).
Sustainable Development	A development that meets the need of the present without compromising the ability of future generations to meet their needs (IPCC, 2018).

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Abbreviations

BMI	Business Model Innovation
CBM	Circular Business Models
CE	Circular Economy
CO2	Carbon Dioxide
CSR	Corporate Social Responsibility
C2C	Cradle-to-Cradle
EOL	End-of-Life
EPD	Environmental Product Declaration
GDP	Gross Domestic Product
GHG	Greenhouse Gas Emission
IE	Industrial Ecology
IO	Input-Output Analysis
LCA	Life Cycle Assessment
NGO	Non-Governmental Organisation
MFA	Material Flow Analysis
PBL	Planning and Building Act
SBM	Sustainable Business Model
SDG	Sustainable Development Goal
SWOT	Strengths-Weaknesses-Opportunities-Threats
TBL	Triple Bottom Line
UN	United Nations

1. Introduction

Recent development of cottages and the human behaviour connected with the leisure-related economy have highlighted a need for change (Vittersø, 2007). The development of the cottages and the lifestyle connected with this affects the biodiversity and touches on a number of the sustainable development goals (SDGs). This may have great impact on a local level and also effects on a global level. Multiple researches are done on sustainable tourism, second-home owners, sustainable tourist accommodations and circular economy, however literature review indicates that there were no research on the potential of circular economy in the leisure-related economy including both economic and environmental perspectives.

The purpose of this study is to develop a circular economy model for the leisure-related economy and for the cottage building. The study tries to investigate the potentials of implementing the model. In addition to that, the study tries to analyse the sustainability of the leisure-related economy and the cottage building and the possibilities and challenges to improve.

1.1. Background and motivation

Cottage life has a long and strong tradition in Scandinavia. In Norway cottages were initially built in connection to farms, the family of the farmers could use them to move to more urban areas to work. The last decades cottages have had a steady and strong increase in popularity (Flognfeldt, 2002, Farstad et al., 2008). The development of cottages and the related tourism are an important part of the tourism industry in many municipalities/regions and also creates significant ripple effects for local income, employment and population (Taugbøl et al., 2001). The market for cottages has increased, and the cottages have become important investments. The development towards higher standards, larger cottages and infrastructure creates conflicts between the demand for infrastructure, such as roads, electricity and water, and the need for nature preservation and public access to nature (Vittersø, 2007). Studies also show that over 90% of the people visiting their cottages uses their car, thus creating a high pressure on the infrastructure and pollution in the environment (Dybedal and Farstad, 2012).

The United Nations Sustainable Development Goals (SDGs), adopted in 2015, provide an established framework for assessing the links between global warming of 1.5°C or 2°C and development goals that include responsible consumption and production, sustainable cities and communities, and climate action. Impacts on natural and human systems from global warming have already been observed and the challenges of climate change and the effect it has on humans, animals and the ecosystem are one of the biggest challenges the humans are facing today. The climate change impacts and responses are closely linked to sustainable development which balances social well-being, economic prosperity and environmental protection (IPCC, 2018).

To achieve the SDGs by 2030 there need to be a rapid change in the system, and the change need to be on a local level as well as on a global level. Sustainable lifestyles can be defined as "living well within earth's limit". The consumption of today's population is not sustainable, and the trend need to turn. Europeans live some of the world's most

unsustainable lifestyles (Vita et al., 2019). To achieve the SDGs by 2030, there needs to be multiple measures done. Implementing a circular economy in the community can be one of the measures to reach the SDGs. One of the measures that can be implemented is to utilize the local resources more, share more, reuse more and recycle more.

Norway need to reduce its greenhouse gas emissions (GHGs) by 80-90% in order to become a low-emission society (Westskog et al., 2018). This reduction requires a restructuring of the society. Restructuring need to happen on a local level as well as in a global level. The built environment is a sector which puts a lot of pressure on the natural environment and its role in transitioning to a circular economy (CE) is crucial, and the building of cottages are part of the build environment. There is a lack of interdisciplinary research in facilitating the transition to circularity. There are challenges to implementing circularity with regards to the society and the economy and interdisciplinary research is essential to solve these challenges (Pomponi and Moncaster, 2017).

Circular economy is currently a concept with increased popularity since stakeholders have started to realise that our planet and our resources are at danger. The consumption of resources and the lifestyle on this planet is not sustainable and this is why a circular economy can be an important contribution towards a sustainable development. CE seems like a promising concept since it has been able to attract both business communities and policy-making communities to sustainable development work. The concept still needs to secure the environmental impact of CE work towards sustainability (Korhonen et al., 2018). CE and material efficiency are key elements to address the challenges of reducing impacts on the environment, whilst at the same time meet the functionality and services required by the society (Walker et al., 2018).

There is awareness of the concept of circular economy (CE), but there is absence of incentives to design products and buildings for disassembly and reuse at the end-of-life (EOL). To encourage greater implementation of CE principles there needs to be a clear economic case, tools and guidance (Adams et al., 2017). Looking at the value chain for constructions of buildings, the acquisition of disposed materials as well as creation a demand for reused solutions seems to be the major challenges to the implementation of the CE principles. Companies that want to integrate reused materials into the value chain have experienced difficulties to receive sufficient access of materials. Also, if reused solutions are developed, in some cases, there is still a lack of market demand due to user's concern about functionality of secondary construction materials. The access of quality and quantity of used resources requires all companies to adapt their business model (BM) (Nußholz and Milios, 2017).

1.2. The main actors of the case study

The leisure-related economy at Oppdal is the case study in this thesis. The project "Grønn fjellhageby" was a pre-project to the project "Bærekraftig fritid" which is an ongoing project by Nasjonalparken Næringshage. The projects are focuses on sustainable leisure-related economy. Oppdal is a mountain community in Norway, and they have more cottages than houses in the community (Statistisk sentralbyrå, 2020a). In these two projects Nasjonalparken Næringshage have arranged workshop with a wide participation from local

communities, businesses, researcher, public administration and politicians in Oppdal and Rennebu municipality. Rennebu is the neighbour municipality of Oppdal. The development of cottages in Oppdal have increased the last decades and they are now working for a sustainable leisure-related economy (Nasjonalparken Næringshage, n.d., Statistisk sentralbyrå, 2020b, Statistisk sentralbyrå, 2020c). Lundhytta is a cottage producer at Oppdal. They are also working with sustainability both when building cottages and in their second business "Grønn Fritid" which is working towards finding sustainable solutions for the cottage building.

1.3. State of the art

In the literature there are several studies that investigate CE and tourism. Manniche et al. (2017), Girard and Nocca (2017) and Rodríguez et al. (2020) studied the opportunities for CE in the tourism sector. Manniche et al. (2017) found that a CE approach recognises that radical redesigns are necessary. The ambitious concept of CE appears to push companies to rethink their business model and the demands of their supplier. Girard and Nocca (2017) found that tourism can represent a threat or a starting point for sustainable development. Circular tourism requires appropriate tools, indicators, knowledge and data. Rodríguez et al. (2020) studied the circular economy contributions to the tourism sector by doing a literature review. The authors found that there are gaps in the literature on CE and tourism. Literature on CE mainly focuses on construction, energy and water consumption, reutilization and new uses and less on other relevant aspects such as circularity of tourist destinations and the application on CE as a model to achieve sustainable development of the local community though synergies with tourism.

Several studies are conducted on the leisure-related economy, cottages and the ripple effect in the leisure-related economy. Vittersø (2007), Farstad et al. (2008), Ericsson et al. (2010), Overvåg (2010), Farstad and Rye (2013), Tangeland et al. (2013), Velvin et al. (2013), Skjeggedal and Overvåg (2014), Ellingsen and Arnesen (2018) and Arnesen and Teigen (2019) all investigated the leisure-related economy in various ways. Leisure time has become more important in terms of time, money and resources that households use on leisure activities (Vittersø, 2007). The increased demand for cottages have made it possible for some municipalities to invest in cottages as a development strategy (Farstad et al., 2008). The people that have a cottage constitute an important market segment for businesses that offer nature-based activities. People with cottages differ from other tourist since they do not require accommodations and often are more independently when organising transportation and meals. For the local leisure-related economy to grow the cottage owners need to spend money also while staying in their leisure homes. According to Tangeland et al. (2013) the intention of spending money on products such as nature-based tourist activities are influenced by the cottage owners motives and demographic variables, the recreation experience preferences and the reason for having a cottage in the area (Tangeland et al., 2013).

Cottage owners advocate conservation of the rural and natural idyll that attracted them in the first place. The locals are more likely to welcome new developments and thus enhance economic value creation of their rural communities. There is a conflict of interest, where the locals want to make a living of the cottage owners and provide economic growth in their local community, and the cottage owners want to preserve the original surroundings

of the cottage. The locals and the cottage owners are claimed to differ in the demographic compositions, value orientations, ways of life, location in the rural economy, location in the national economy and their relation to the rural landscapes. Farstad and Rye (2013) argues that the conflict concerning land use in municipalities where cottage owners are a large part of the population are not between locals and the cottage owners, but between those initiating different kinds of new developments and those appreciating the already existing qualities and appearance of the areas of development localisation. The authors also found that locals do not seek rural development as eagerly as often presented, and cottage owners are not as reluctant towards development as often presented.

The value chain from raw land to cottage, and the value chain that is connected with the use of the cottages have been analysed by Arnesen and Teigen (2019), Moe (2019) and Velvin et al. (2013). Arnesen and Teigen (2019) found that 8 out of 10 cottages are owned by people that are not living in the municipality where the cottage is located. When the cottage owners are building the cottage and traveling to the cottage, this is a big transfer of private capital from city to the mountain region which means increased income to the region. Arnesen and Teigen (2019) have examined the value creation in the local community from the building of the cottages and the use of the cottages. The development of high standard cottages has accelerated and there is a pattern that larger construction companies have increased their market share for the construction of the new cottages. The smaller and more local companies lose the competition to the larger companies, and then the value creation in the local community decreases (Moe, 2019). For the municipality to get the most value out of the cottages they need to be active already in the planning phase of the raw area for the cottages. In the article of Moe (2019) there is a warning of dividing land into lots of small plots for cottages instead of bigger land plots that allows for later costs, such as building annexes and expansions of the cottages which may facilitates the use of local suppliers. The municipality can also try to keep the head offices and their owners locally since these are the one that treasure the most and can hire local labour. It is also important to understand what the cottage owners want which can create new employment possibilities and increased value creation (Moe, 2019). Velvin et al. (2013) found that the municipality is of great importance in the determination of the degree to which second homes will lead to local value formation. The municipality works as an active planning authority for the local trade structure. The regulation of the cottage land area are also one of the roles the municipalities has. Velvin et al. (2013) also found that it appears that large cottages in concentrated areas leads to economic sustainability, and long-term socio-culture and ecological sustainability. The concentrated areas may give easy access to social and cultural services and at the same time areas with important natural amenities can be protected. The provision of quality water supply and sewer systems in regulated areas would also minimize the pollution from the use of the cottages.

The economic ripple effect of cottages are investigated by Ericsson et al. (2010). The study has divided the economic effect into three categories; the economic effect on the municipality, the local economic effect and the effect on industrial and rural development. The economic effect on the municipality includes the income from the property tax, and also such as development of infrastructure (roads, drains, water, etc.) and municipal services within health care and safety. The local economic effect of the development of the cottages are mainly due to the money that the cottages owners use in the area. The cottage

owners are adding money into the local community when buying land, building the cottages, and when using the cottage. The effect on the industry and the rural development is due to the development of the destination, development of the goods and services specifically aimed at the cottage market, and the collaboration between local industry. The sale of land or lease of land is only a pure investment of assets, but it may be necessary to release capital and thus contributing to an economic effect from the increased capital in the local area. These three categories are also affected by the localisation of the cottages, the distance from the cottage and the home of the cottage owners and the availability of activities and services.

Cottages can also contribute to strategic business and rural development. The cottage owners are an important customer group for the development of the destination, landowner collaboration, development of goods and services aimed at the cottage owners' segment, collaboration between local industry for a business development. The cottage owners can engage locally or the cottages can contribute to the more comprehensive development of the infrastructure of the destination (Ellingsen and Arnesen, 2018). The development of cottages comes with several types of environmental challenges, such as the land use may conflict with the protection interest (Ellingsen and Arnesen, 2018, Skjeggedal and Overvåg, 2014). The land that is used for the cottages also have an alternative cost, such as a conflict between agricultural interest and reindeer husbandry. Overvåg (2010) found that commodification of rural areas is linked to exploitation of the physical environment, including the reallocation of resources of land from marginal agriculture and abandoned industrial sites into development of cottages. The reallocation of resources has also been an economic driving force for the related development of infrastructure, housing and tourist.

The research to date has not tend to focus on circularity in the leisure-related economy and the cottages, however there are several studies done on building and residential houses. Due to the high standards of the new built cottages one can argue that is interesting to include also this literature in the state of the art.

Various approaches to investigate the environmental impacts from the cottages, buildings and residential houses are used. Thorvaldsen (2019) and Nordby (2011) studies environmental impacts of cottages, and used LCA to examine how to improve the impacts. They used different cottages as model for the LCA and examined different impacts. Thorvaldsen (2019) did an LCA of three different cottages at Oppdal to examine the biodiversity loss. The study found that there are considerable possibilities for reducing the loss of biodiversity by changing the way cottages are built, by building more area efficient cottages areas, by changing the changing the transport options towards public transport and by changing the use of wood as a source for heating. Nordby (2011) examined the carbon reduction for Norwegian mountain cabins using LCA, and found that alternative measures like area efficiency, material substitution and material reuse have potential to improve the impacts of these wood-fire cabins. The measures related to the materials are in general more robust in climate change mitigation than the measures that facilitates energy efficiency. Dahlstrøm et al. (2012), Skåren (2012) and Azimi (2019) examined the use of wood materials in buildings. Cottages are usually made of wood, and the studies

found that wood materials are used mostly for smaller building and there are several advantages by using wood as a building material in prefabricate buildings. One of these advantages was that wood is easy to reuse and recycle. Dahlstrøm et al. (2012) used LCA to compare environmental and resource impacts of wooden single-familiy residences to meet the conventional Norwegian building code from 2010 (TEK10) and the Norwegian passive house standard NS 3700. The results showed that the cumulative energy demand have a reduction in the passive house design compared to the standard TEK10. The results indicate the gains of improving the efficiency standard of buildings.

LCA is a widely used method to assess the environmental impact of buildings and studies such as Nasir et al. (2017), Hossain and Ng (2019), Nußholz et al. (2019), Minunno et al. (2020) and Nußholz et al. (2020) have used this method. Nasir et al. (2017) compared and evaluated the environmental impacts associated with the supply chain of building insulation products from recycled materials to those associated with traditional linear supply chain products. The study found that the insulation material made from recycled materials exhibits lower total CO_2 emissions within the product life cycle than the insulation material that followed a linear supply chain. Hossain and Ng (2019) examined aspects at different life cycles of buildings and the findings indicate that the total impacts can be reduces if material recovery principles are adopted. Minunno et al. (2020) applied an LCA to a building that has been prototyped with the purpose of studying the feasibility of creating a CE construction. Then they compared reuse and recycle to examine which practice have the greater environmental benefit. The results of the study indicate that, compared to recycling, designing and building for reuse components offsets greenhouse gas emissions by 88% while also benefiting several other tested environmental indicators. Nußholz et al. (2019) also applied LCA to investigate carbon saving in buildings, but used a comparative study to investigate the carbon savings potentials in circular buildings, and the role of business model innovation and public policies. The study found that carbon saving potentials depend on which harmful process in the primary material production that is replaced by the reused material. Companies have barriers to implement use of secondary materials, and business model innovation was a measure to overcome some of them, and additional policy inventions are crucial to remove the remaining barriers. Nußholz et al. (2020) uses a multi-method approach to explore how a business model for material reuse in the building sector affects value creation. The findings indicate that business models have great potential to ensure that reused materials are price-competitive with linear produced materials, to offer value for the customer, the value chain and to provide significant reductions in the environmental impacts.

Literature reviews are also used to investigate the environmental impacts of buildings. Hossain and Ng (2018) and Foster (2020) both used literature reviews to investigate environmental impacts of buildings. Hossain and Ng (2018) made an analytical literature review of the buildings' environmental impact assessment towards adaption of CE. Buildings are complex systems and the existing literature are considering different impacts, buildings and considerations. The study found that LCA, MFA and design tools can be integrated to facilitate the implementation of CE. Foster (2020) examine strategies for adaptive reuse of cultural heritage buildings to reduce environmental impacts by doing a literature review. Reducing throughput and the total amount of resources used in the

construction industry is the goal, and therefore acknowledge the value of higher-level strategies.

1.4. Problem description

The world is in need for a rapid change to achieve the SDG goals within 10 years. The changes need to be on a local level as well as on a global level. The building sector is a major contributor to global carbon emissions and is responsible for one-third of the global GHGs (UNEP, 2009). The leisure-related economy needs to develop towards a sustainable development. The purpose of this thesis is to develop a circular economy business model for the leisure-related economy.

The model also includes a micro-system for the cottage building. There could be several micro level systems in the macro level model for leisure-related economy, but due to the potential contribution towards a sustainable leisure-related economy from the buildings this was chosen as the micro level system to further investigate. The study therefore investigates the possibilities and challenges to implement circular business models in the leisure-related economy with a focus on the cottage building. The thesis explores the possibilities for the leisure-related economy to become more sustainable with regards to the economic and the environmental perspective. The study tries to investigate sustainability in the leisure-related economy and the potential of implementing CE. The thesis aims at contributing to the existing research and come with recommendation for a more sustainable and circular leisure-related economy.

This thesis will analyse the extent of sustainability in the leisure-related economy by examine the sustainability regarding the building of the cottages. To investigate the purpose of this thesis some research questions (RQ) have been designed.

RQ 1: How sustainable is the leisure-related economy in Norway?

RQ 2: How can the leisure-related economy become more sustainable?

RQ 3: How can principles from circular economy affect the sustainability in the leisure-related economy?

The research questions start at a more general level with investigating the current situation of sustainability in the leisure-related economy and how it can become more sustainable, before the implementation of the CE model in the leisure-related economy is investigated. To answer these research questions a case study has been conducted. The case studied is a mountain leisure-related economy, Oppdal in Norway.

1.5. Structure of the thesis

This master thesis is divided into eight chapters. The first chapter has given a brief overview of the topic, the main actors in the case study, an investigation of the state of the art and the gaps in the literature, the problem description where also the research questions are defined. The second chapter describes the research process, and some terms are defined before an overview of the literature review is presented. In this chapter the research design, chosen method for acquiring data and the methods for data analysis is

presented. In the end of this chapter some reflections is presented. In the third chapter presents the theoretical framework. In the fourth chapter, the circular economy model for the leisure-related economy is developed. The model is based on the current literature and the theoretical resources. The model is divided in one macro level model and one micro level model. In the fifth chapter the empirical data is laid forth. The empirical data is also divided into macro level data and micro level data. Chapter six is where the results and analysis are presented and conducted. The chapter include a system analysis, a SWOT analysis and an analysis of the connection to the SDGs. In the end of chapter six is the research questions from chapter one examined based on the results and analysis. The seventh chapter is a discussion of the limitations of the study, an evaluation and discussion of the circular economy model, an evaluation and discussion of the case study and in the end a reflection on the reliability, validity and generalisability of the study. The eight and last chapter is where a conclusion is conducted. This chapter also includes recommendation and suggestions for further research. An overview of the study is also presented in Figure 1, based on Davis (1995).

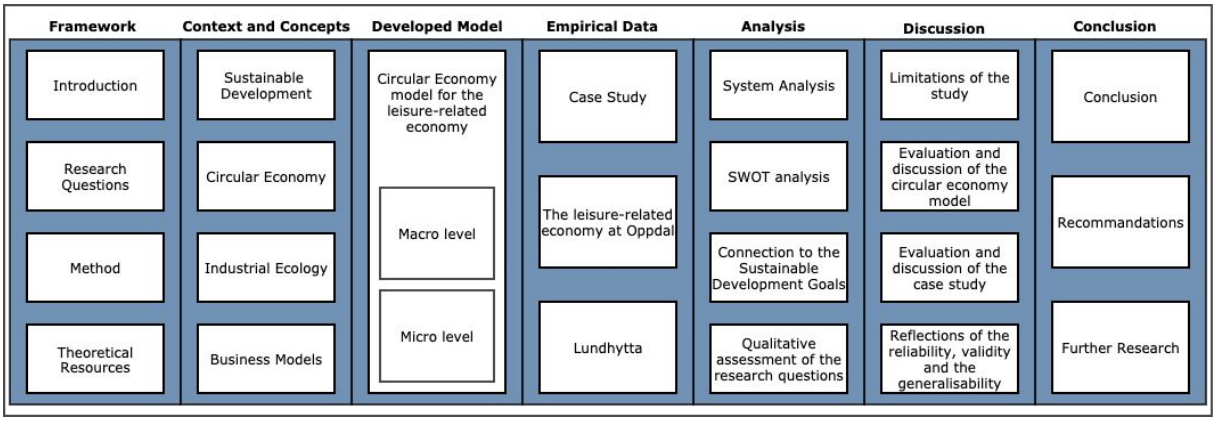

Figure 1: Overview of the study.

2. Method

This chapter presents the main methodological aspects used to accomplish the purpose of this master thesis will be elaborated. First the research process will be explained, before some terms will be elaborated. Thereafter an overview of the literature review is presented before the development of the model is elaborated. Then, the research method and design will be presented. Thereafter, the research acquisition is presented. In the end there will be a section of how the analysis is conducted before this chapter ends with a section where reflections and limitations of the study is discussed.

2.1. The research processes

To investigate the RQs a case study has been the chosen method. The figure shows how the research process is a dynamic and interactive process with many iterations.

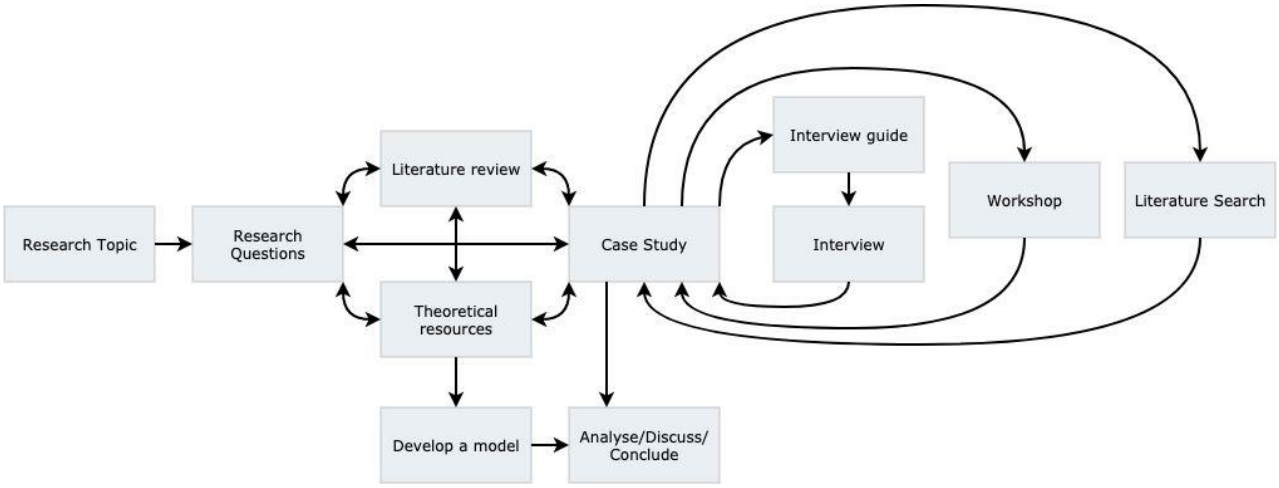

Figure 2: Present a simplified version of the research process.

As Figure 2 show, this has been a dynamic process where the different processes have been more towards a circular process than a linear process. The process started with having a research topic of circular economy and industrial ecology. After the research topic was chosen the RQs was formulated and reformulated after doing literature reviews and finding relevant theoretical resources. RQs that have a "why" or a "how" are good questions to base the case study on (Yin, 2018) and thus, case study was the chosen research method. Shaping/re-shaping the research questions, finding relevant theory, doing literature review and making a case study was a dynamic process. Finding the literature and doing literature reviews shaped the research questions and the case study, which specified the search for theory and the literature review further, and this continued for some iterations. Data has been collected through literature search, observing workshops and dialogue with companies' representatives in the leisure-related sector. The data collected was drawn into a system to make it easier to analyse. The literature review and the theoretical resources also contributed to developing a circular economy model. The information collected in the data acquisition was systematised and thereafter analysed, discusses and a conclusion was drawn.

2.2. Terms

When conducing this study, it appeared some terms that was widely used in Norwegian, but that there was a struggle finding a good English translation. There were several English words that was used for the same Norwegian word, but none of them was really a perfect match. Therefore, this section will have a Norwegian – English translation of the words, and the terms that are used in English will be explained to better understand the meaning of the terms that are used. The translation of the terms is to be found in Table 1, and the terms used are explained below the table.

Table 1: Translation of terms from Norwegian to English

English	Norwegian
Cabin	Hytte
Cottage	Fritidsbolig
Cottage owners	Eier av fritidsbolig
Holiday houses	Feriehus
Leirsure-related economy	Fritidsøkonomi
Second homes	Sekundærbolig
Tourist	Turist
Vaction homes	Feriehus
Work traveller	Jobbreisende

Cottage is in this thesis a term that is used for a housing where people do not have a permanent residence, but are used for recreational purposes, relaxation and leisure activities. The cottage can be of different standards, some have cottages that is the same standard as a house and other have cottages that are without electricity and water facilities. Both older, simple cottages and new, high standard cottages are included in the concept. Cottages are usually a sea cottage or a mountain cottage, and since this thesis is focused on Oppdal the cottages discusses are mountain cottages. When Farstad et al. (2008) defined cottages they also included that cottages are not depended on size, location or the season of the year it is used. Other similar terms that are used in literature are cabin, second homes, vacation homes and holiday houses. The different terms are used interchangeably, but the difference is found in the "Skatte-ABC 2019/2020" by the Norwegian Tax Administration. So, the different definitions there have different taxation (The Norwegian Tax Administration, 2019).

Cottage owners is defined as the person(s)/family that owns the cottage.

Leisure-related economy is a term that includes the cottage and the money people that are visiting their cottage are using while there, the nature and activities that these people use and the transportation methods that are available to access the cottage. The leisure-related economy is also including the tourists and the work travellers.

Tourist are the people visiting the leisure community for pleasure, but do not own their own cottage. Tourists may stay in hotels, use AirBnb, tent or recreational vehicles.

Work traveller is people visiting the leisure community for business, but do not own their own cottage.

2.3. Literature review

Circular economy is a massive field and there are multiple practices and research done. The field is relatively new, and growing fast. The leisure-related economy also has multiple studies done. To narrow down the literature review the literature search was mainly

focused on literature about the leisure-related economy in the mountains in Norway. The literature search for cottages are also focused mainly on cottages and houses in Norway, this was mainly done to take the different weather conditions in to account, since the buildings in different countries have different requirements as there are different needs. The literature review is done mostly in the scientific database Scopus, Google Scholar and Research Gate. Table 2 below will present the documents that is of most importance for the literature review in the state of the art.

Table 2: The literature review for the state of the art.

Search	Relevant Outcome
Scopus: "Circular Economy Cottages": 0 hits "Circular Economy Cabins": 0 hits "Circular Economy Leisure": 4 hits, not relevant. "Circular Economy Holiday": 4 hits, not relevant. "Circular Economy Tourism": 84 hits, 2 relevant. "Circular Tourism": 11hits, 1 relevant. "Norwegian Mountain Cabins": 6 hits, 1 relevant. "LCA Residential Houses Norway": 2 hits, not relevant. "LCA Single-family Residence": 6 hits, 1 relevant. "Second Home Owners Norway": 18 hits, 3 relevant. "Circular Economy + Construction + Materials": 470 hits, 4 relevant. "Material Reuse in Cottages": 2 hits, not relevant. "Material Reuse in Cabins": 8 hits, 1 relevant. "Material Reuse in Buildings": 1745 hits, 1 relevant. "Circular Supply Chain": 714 hits, 1 relevant. "Adaptive reuse + circular economy": 12 hits, 1 relevant.	Rodríguez et al. (2020) Girard and Nocca (2017) Nordby (2011) Dahlstrøm et al. (2012) Velvin et al. (2013) Tangeland et al. (2013) Farstad and Rye (2013) Nußholz et al. (2019) Minunno et al. (2020) Hossain and Ng (2018) Hossain and Ng (2019) Nußholz et al. (2020) Nasir et al. (2017) Foster (2020)
Google Scholar: "Circular Tourism": 232 000 hits, 2 relevant. "Bærekraftige fritidsboliger": 561 hits, 1 relevant. "Bærekraftige hytter": 1880 hits, 1 relevant. "Norwegian Mountain Cabins": 9140 hits, 1 relevant. "Wooden cabins": 44 700 hits, 1 relevant. "Wooden Cottages": 49100 hits, 0 relevant. "Trekonstruksjoner Norge": 695 hits, 1 relevant. "Wooden constructions Norway": 25 400 hits, not relevant. "Second home owners Norway": 209 000 hits, 4 relevant. "Fritidsbebyggelse": 1040 hits, 2 relevant. "Fritidsboliger": 1230 hits, 2 relevant.	Manniche et al. (2017) Ericsson et al. (2010) Thorvaldsen (2019) Azimi (2019) Skåren (2012) Overvåg (2010) Vittersø (2007) Ellingsen and Arnesen (2018) Farstad et al. (2008) Arnesen and Teigen (2019)
ResearchGate: "Fjellkommuner I Norge": 1 relevant hit.	Skjeggedal and Overvåg (2014)

The theoretical resources are mainly based on literature search in Scopus, Google scholar, Oria and books. For the sources where it was relevant and possible a backwards search was conducted to find the original work that have been cited. The references were then analysed and found.

2.4. The circular economy model for the leisure-related economy

An industrial ecology model is a representation or description designed to show the structure or operation of an object or a system. A model is conceptual and speaks to the structural aspects of the definition, and seeks to represent the components of the object or system of interest, and the potential for interaction among the component (Graedel and Allenby, 2010).

The circular economy model for the leisure-related economy is built on aspects from circular economy models and industrial ecology models, and built up using the theoretical resources and the research done. The model has been though several iterations after dialogue with Nasjonalparken Næringshage, and with other actors for more insight and to ensure quality in the model. The model is divided into a macro system for the leisure-related economy and a micro system for the cottage building. The macro system could have many micro systems, and also the cottage building could be divided into several micro systems. The leisure-related economy is complex and therefor the model is a simplification of the system. The model includes material flows and knowledge/competence flows, and do not focus on the energy and water flows.

2.5. Research design/method

In this section the chosen research method/design is a qualitative study with a single case study. In the section below are case studies explained.

2.5.1. Case studies

Case studies are used to study particular phenomena in particular settings. Case studies can evaluate the efficiency of the particular theoretical resources by observation of the empirical data. This method is well known in business research and is particularly useful for the analysis of organisation and is often used to determine if a certain approach works in a particular setting. In case studies a combination of observation, surveys and interviews is typically used (Adams et al., 2014).

The case study starts with identifying if a case study is the relevant research method to use compared to other research methods. Case study is the preferred method, compared to other methods, in situations where the main research questions are "how" or "why" questions (Yin, 2018). As the research questions in this thesis are "how" questions, a case study is found to be the most appropriate research method. Then, define the case study and identify the case study design. The case study design can be single or multiple, holistic of embedded cases (Yin, 2018). A single case study was chosen as the design due to the topic of the thesis, and due to the time frame. To prepare for the case study, the most relevant data collection method should be chosen. In this thesis interview, workshop and literature search was chosen as the main method of data acquisition because it was relevant to not only conduct information about the materials and energy flows, but also their motivation to participate in a circular economy model and implementing this is their strategy. The data collection also shapes the definition of the case study and so this is a dynamic process. The data collected in this case study is then analysed and discussed.

2.6. Data Acquisition

The primary source of data was the interview and the observation of a workshop. The literature search was a secondary source of data. In the sub-sections below these data acquisition methods are explained more thoroughly.

2.6.1. Interview

Interviews are the most common research acquisition method for qualitative data (Johannessen et al., 2010). Kvale and Brinkmann (2009) characterises a qualitative

research interview as a conversation with structure and a purpose. Interviews allows a mass of information to be collected. The study uses in-depth research interviews with a semi-structured approach. Semi-structured interviews are interviews that uses the interview guide as a base, but the order of the question can vary. The interview is a dialogue and goes back and forth in the interview guide (Johannessen et al., 2010). In a semi-structured interview, the interview guide function as a "road map" of questions which guides the interviewer though the interview. This gives the interviewer the flexibility to steer the interview to make sure the topics were covered. The questions in the interview guide were supplemented with follow up questions to reply and creating a more natural dialogue (Adams et al., 2014).

An initial interview guide was made in preparation of the interview. According to Adams et al. (2014) the interview guide should always be pre-tested to reveal and correct errors or problems. It is crucial to know how to ask questions and formulating good questions. The interview guide was pre-tested. After the pre-test, the language in the interview guide was revised. Thereafter the interview guide was revised again with guidance from the supervisor. After these iterations, the interview guide was pre-tested again and then the interview was conducted. The interview guide was made with open questions around the topic so the interview object could talk freely. The supplementary questions were to be asked to gain more thorough descriptions of the interview object answers. The interview guide was divided into three main categories of questions to accentuate the topic of the thesis. The interview guide is to be found in the appendix, A.1. The interview guide (Norwegian), and A.2. The interview guide (English) for the translated English version.

Before the interview was conducted, the interview guide was sent to the interviewee so the interviewee could gather the needed information and prepare to the interview. At the same time a consent form was sent with information about the project and how the information would be handled. When conducting the interview, according to Adams et al. (2014) the interviewee should talk at least 80 percentage of the time. The interviewer needs to listen to the interviewee, but be firm so the interviewee sticks to the area that is asked. The interviewer also needs to be careful not to lead the interviewee. The interview is volunteer, and at any point in the process of the project the interviewee can subtract its confirmation. This can affect the relation between the interviewer and the interviewee, even though this study did not conduct personal or sensitive data. A good introductory phase of the interview is crucial to get a good relation with the interviewee, and having the interviewee feel comfortable could affect the success of the interview (Johannessen et al., 2010).

The interviewee was chosen after conversations with professionals (Nasjonalparken Næringshage) to better evaluate who could give value to this case study with their specific knowledge and experiences. In this case study telephone interview was the only option to collect data. There are advantages and disadvantages by telephone interview. Advantages are such as easier geographical coverage and it is less time consuming. There are also some disadvantages such as, the lack of understanding non-verbal cues and the communication can be less organic, which may affect the interview (Adams et al., 2014). In this thesis, the lack of opportunity to see the facilities are also a disadvantage.

2.6.2. Workshop

There was supposed to be held two workshops with Nasjonalparken Næringshage and PirII about the ongoing projects on Oppdal, "Bærekraftig Fritid". The author was observing the first workshop, and then the second workshop was cancelled. Observation is usually time and resource demanding. It is used to understand how social phenomena evolves, and how to interpret them. The researcher sees what happens, hear what is being said and collect data in a holistic perspective. Observation might give access to information that is hard to conduct though other methods (Johannessen et al., 2010, Mason, 2002).

In the workshop there was participants from different sectors and working with sustainability in various ways. In this workshop it was mostly participants from research institutions and innovation, local businesses and representatives from the municipality. The participants knew the author was there to facilitate the workshop, but the author was not participating in the workshop. The aim of the observation of the workshop was to gain insight in the work that is done on sustainability, the thoughts of how the previous projects have been received, thoughts about the sustainability in the leisure-related economy and thoughts of how sustainability should be implemented in the leisure-related economy.

2.6.3. Literature search

A literature search was also conducted for the empirical data. Data on the development of the cottages in Oppdal was retrieved from Statistic Norway (SSB), the Norwegian statistics bureau. Data was also collected though "Hytteundersøkelsen i Oppdal 2015" which is report of a survey that was conducted in 2015 by Nasjonalparken Næringshage. The participants in the survey was the cottage owners in Oppdal that have a permanent residence outside Oppdal. The survey was online and 689 of 3088 participants responded. The participants in survey can be assumed to be representative for the cottage owners (Jystad, 2015).

Data from Menon Economic was also used to collect information about the leisure-related economy. The reports "Modell for fellesgodefinansiering i Oppdal" from 2013 and "Økonomisk analyse av reiselivet i Oppdal" from 2020 was used to gain insight into the leisure-related economy. The reports are focused on value creation and ripple effect in Oppdal. The reports from 2013 was conducted for Nasjonalparken Næringshage and the 2020 report for Oppdal Næringshage. The reports are made by a third part, and have gathered information from different actors and are assumed to be reliable. The reports however do not have a focus on the environment, only the economic aspect.

2.7. Data Analysis

The next step in the research process was the data analysis. In this thesis there are three methods used to analyse. The analyse methods chosen for this thesis is system analyses, SWOT-analyses and an analysis of the connection between the CE model for the leisure-related economy and the case study to some SDG targets.

2.7.1. System Analysis

Graedel and Allenby (2010) defines a system as a group of interactions, interdependent parts linked together by exchanges of matter, energy and/or information. The parts and interactions of the system are subject to a common plan and serving a common purpose.

There are two types of systems; simple and complex. The simple systems are not combined or compound. The complex systems consist of interconnected parts and are more difficult to understand. Industrial ecology has technology at its core, but links the technology to human actions (the social system) and to nature (the environmental system). It deals with systems of systems, and once a system of interest has been defined, the next step is to determine how the system works. Industrial ecology systems are purposeful. They are also predictive when it concerns technological products and processes, but human actors in the system makes it complex. The system then needs to be discussed with a multidisciplinary approach to cope with the social and the environmental aspects of the system (Graedel and Allenby, 2010).

The macrosystem made in the case study is Oppdal and the leisure-related economy. The microsystem made in the case study is the processes of building a leisure-home, and the specific case of Lundhytta as an example. The systems are drawn based on the information acquired in the empirical data. The system is then analysed and compared to the circular economy models that will be presented in chapter 4.

2.7.2. SWOT Analysis

A SWOT analysis was conducted to examine the strengths, weaknesses, opportunities and threats on a macro level and on a micro level in this case study. SWOT analysis structures the information and builds a good basis for decision making (Johannessen et al., 2010). The SWOT analysis considers both the external markets with regards to opportunities and threats in the market, and used the internal analysis to find the strength and weaknesses, and this information can be used to investigate new strategies and business opportunities.

2.7.3. Connection to the Sustainable Development Goals

Based on theory on circular economy some SDGs are chosen to investigate the connection of the circular economy principles in the leisure-related economy on the SDGs. A few targets are chosen to investigate this further. The relevance of a few chosen indicators are also examined. The analysis is conducted to examine if there is a connection between the circular economy approach in the leisure-related economy and the selected SDGs, and how CE are used as a tool to contribute to achieving the selected targets in the selected SDGs.

The Sustainable Development Goals scoring analysis

The data collected was examined with regards to the SDGs. There is a natural linkage between the SDGs, and the interaction between the suitable SDGs for this thesis are also examined. The trade-off between the SDGs are based on the methodology proposed by International Council for Science (2017). Understanding the interactions between the SDGs is key to unlock the full potential and to ensure that progress in one area are not done at the expense of progress in others. The International Council for Science (2017) framework have a scale from -3 to +3, whereas the negatives on the scale are trade-offs and the positives on the scale are positive interactions. On this scale progress on one target acts to cancel progress on another to where progress on one goal is inextricably linked to progress another. The scale do not consider all the relations between the SDGs, but provide

a sufficiently wide range of classify most relations (International Council for Science, 2017). The scale is presented in Table 3.

Table 3: Interaction scale for the Sustainable Development Goals.

Interaction	Name	Explanation
+3	Indivisible	Inextricably linked to the achievement of another goal
+2	Reinforcing	Directly aids the achievement of another goal
+1	Enabling	The pursuit of one objective helps the achievement of the other objective
0	Consistent	No significant positive or negative interaction
-1	Constraining	Limits options on another goal
-2	Counteracting	Clashes with another goal
-3	Cancelling	Makes it impossible to reach another goal

2.8. Reflections and limitations

Qualitative research methods are useful to study the complexity of a case, but this research method also have limitations. The limitations concerning qualitative research methods and especially case studies are discussed in this section. There are no sensitive data that needed to be collected for this study, but there are still ethical considerations that will be presented in the section below. There are usually three criteria that are used for testing and evaluating measurements of variables and ensuring the quality of data, research design methods and the accuracy of the findings. The three criteria are reliability, validity and generalisability, and will be presented in this section.

2.8.1. Ethical considerations

In Norway, ethical considerations connected to personal data privacy in research projects are regulated by the Norwegian Centre for Research Data (NSD). The acquired data do not content any personal or sensitive information, but needed to be applied for at the NSD before the information was collected. It was made a consent form with information about the research, and this was sent to the interviewee. The interview guide was also sent to the NSD as part of the application for this study.

2.8.2. Reliability

Reliability is the concept of the consistency of the study. If the results of the same measures are always the same, the results are reliable. This means that if the outcome of the measuring process is reproductible, the measurement instrument is reliable (Adams et al., 2014). The goal of reliability is to minimize the errors and make it possible for researcher to follow the same procedures to study the same case over again (Yin, 2018). To do so, the process of conducting the case study is explained as explicit as possible.

2.8.3. Validity

Validity is the strengths of the conclusion, interference or proportions. The validity is the accuracy of the measurements and to which degree the measures are measuring the what is supposed to be studied. Validity is usually divided to four types of validity tests; internal validity, external validity, construct validity and conclusion validity. Internal validity is the relationship between conditions, if certain conditions are believed to lead to other conditions. Pattern matching, explanation building, addressing the rival explanations and the use of logic models are tactics that could be used to deal with the validity test of

internal validity. External validity is the ability to generalise the results in the study. Tactics that can be used to deal with this test in a single-case study is the use of theory. Construction validity is the test of identifying correct operational measures for studied concept. This test asks if there is as relationship between the operationalisation of the concepts in the study and the actual causal relationship that is supposed to be studied. Tactics that can be used to deal with this test are the use of multiple sources of evidence and to have key informants review the draft of the case study report (Yin, 2018, Adams et al., 2014). Conclusion reliability is the test of the which degree the conclusions reached about relationship in the data are reasonable. The test is to find or not find a relationship between the cause and the effect (Trochim, 2020, Adams et al., 2014).

2.8.4. Generalisability

The concept of generalisability is to which extent the findings in the study can be applicable outside this research and can be applicable in other settings. The goal of generalisability is to be able to explain the same and similar phenomenon at all times and in all places without having to study that directly at all times in all places (Adams et al., 2014). Generalisability for case studies are using an analytical method. The analytical generalisability is based on previously developed theory that is used as a template to compare the empirical results of the case study. The greater the amount of case studies that show the same findings, the greater is the rigidity of the established theory, and if two or more cases support the same empirical results, replication can be claimed (Rowley, 2002).

2.8.5. Limitations

The limitations of this study concern the chosen research method, the circular economy models, the case study, and elements considered due to the timeframe. The limitations will be discussed in section 7.1.

3. Theoretical Resources

In this chapter the SDGs that has been considered relevant for circular economy are introduced, followed by a section about climate change. The concept of sustainability will be defined and presented thereafter. Then there will be a section where circular economy will be defined and presented, and a section where industrial ecology will be presented. Thereafter there will be a section on business models, which includes business model innovations, sustainable business models and circular business models. Then there will be a section on value creation in sustainable business models and circular business models, before there is a section on the implementation of the sustainable and circular business models.

3.1. Sustainability Development Goals

In 2015 the UN adopted the 2030 Agenda for Sustainable Development including its 17 Sustainable Development Goals (SDGs) and 169 targets. The Agenda is a commitment to achieve a sustainable development word-wide by 2030 (European Commission., n.d.). The SDGs include the social, environmental and economic dimensions of development, the triple bottom line (section 3.3). The SDGs include poverty and hunger; ensuring health and well-being, education, gender equality, clean water and energy, and decent work; building and ensuring resilient and sustainable infrastructure, cities and consumption; reducing inequalities; protecting land and water ecosystems; promoting peace, justice and partnerships; and taking urgent action on climate change (IPCC, 2018).

The SDGs that can be connected in the most direct way are Goal 8, Goal 9, Goal 11, Goal 12, Goal 13 and Goal 15. Some targets are chosen to investigate further, these are showed in Table 4. The more detailed information about each target and indicator are to be found in the appendix, A.3. Selected Sustainable Development Goals.

Table 4: Sustainable Development Goals, targets and indicators.

Sustainable Development Goal		Target	Indicator
8	Decent work and economic growth	8.4. 8.9.	8.4.1. 8.4.2. 8.9.2.
9	Industry, Innovation and Infrastructure	9.1. 9.5.	9.5.1.
11	Sustainable cities and communities	11.4. 11.A.	11.4.1.
12	Responsible consumption and production	12.2. 12.5. 12.6. 12.8. 12.B.	12.2.1. 12.2.2. 12.5.1. 12.6.1. 12.8.1. 12.B.1.
13	Climate Action	13.2. 13.3.	
15	Life on land	15.5. 15.9.	15.4.1.

3.2. Climate change

In the recent decades, the impacts of climate change on natural and human systems on all continents and across the oceans have occurred. Continued emission of greenhouse gas

emissions (GHG) will increase the global warming even further and long-lasting changes in all components of the climate system, increasing the likelihood of severe and irreversible impacts for people and ecosystems. A substantial and sustained reduction in GHGs together with adaption is required to limit the climate change (IPCC, 2014). The implementation of the Paris Agreement is crucial to reduce the greenhouse gas (GHG) emissions and increase the ability to adapt to the adverse impacts of climate change. The Paris Agreement has a goal to limit the global temperature rise to well below 2°C above pre-industrial levels before the end of this century, and it also pursued efforts to limit the temperature increase to 1,5°C above pre-industrial levels. Risks to health, livelihood, food security, water supply, human security, and economic growth that are related to the climate are projected to increase with a temperate increasing by 1,5°C and even further with 2°C (IPCC, 2018).

3.3. Sustainability

Sustainability is the process that guarantees the persistence of natural and human systems in an equitable manner, and a sustainable development is a development that meets the need of the present without compromising the ability of future generations to meet their needs. A sustainable development balances social, economic and environmental corners (IPCC, 2018). The social, economic and environmental corners are known as people, profit and planet, the 3Ps.

Sustainability is often mentioned by businesses, non-profit organizations and governments, but it is often difficult to measure to what degree they are sustainable. The theory of triple bottom line (TBL) recommends businesses to commit to focus on people, profit and the planet. TBL aims to measure the financial, social and the environmental performance, because a business that do not account for social and environmental costs, do not account for the complete cost of doing business. The TBL can be used as a tool for a business to reach their sustainability goal. A challenge with TBL is to measure the social and environmental responsibilities (Kenton, 2020).

3.3.1. Economic growth and sustainable development

On a global scale the world is facing the problem of a growing population with a growing need of resources. The world is more and more connected and depended on each other. The sustainable development concept is described thought the TBL. The economic growth is included in the dimension of economic development in the TBL. The economic growth is based gross domestic product (GDP). Economic growth often means increased energy consumption and this leading to increased CO_2 emissions (Wang et al., 2018b).

Degrowth

Degrowth is a critical view of the continues economic growth and also to economic growth as a political goal (Sandberg et al., 2019, Victor, 2010). Kallis (2011) defines degrowth from an ecological-economic perspective. It is defined as a socially sustainable and equitable reduction of the energy and the materials of the society. The energy and the materials of the society refers to the amount that is extracted, processed, transported and distributed to be consumed and returned back to the environment. The principles of degrowth is based on the opination that sustainable use of natural resources requires more fundamental changes to the organization of society, this also refers to reduction in

production and consumption in developed countries (Sandberg et al., 2019). Degrowth departs from the sustainable development and the TBL.

Green growth

Green growth relies on technological and market innovation to improve the efficiency of production, hence decouple the use of natural resources and environmental impacts from continued economic growth (Sandberg et al., 2019, UNEP, 2011). Green growth is a central component in the term "Green Economy". Green growth is built on the belief that environmental sustainability can be achieved while the economic and social system that occur in today's societies are maintained. The theory argues that economic growth and preservation of the natural environment is goals that be achieved at the same time. To achieve the goals simultaneously there is a need for technical innovation to separate the growth of the economy from the growth in the usage of natural resources and the environmental impact (Sandberg et al., 2019).

3.4. Circular Economy

Circular economy have been defined in various ways, and Kirchherr et al. (2017) made a review of 114 CE definitions and analysed them. They found that CE means many different things to different people. CE and the practical contribution to economic systems and industrial processes has different features and contributions from a variety concepts that builds on closed loops (Geissdoerfer et al., 2017). Barry Commoner presented the four laws of ecology in 1971 in the book "The Closing Circle"; (1) everything is connected to everything else, (2) everything must go somewhere, (3) nature knows best, (4) there is no such thing as free lunch (Commoner, 2020). Commoner approaches ecology from a systems perspective and shed light on sustainability. In 1976 in a report to the European Commission, "The Potential of Substituting Manpower of Energy", Walter Stahel and Genevieve Reday introduced the focus on the concept of loop economy to describe industrial strategies to create regional jobs, prevent waste, resource efficiency, and dematerialisation of the industrial economy (Das, 2020). In 1994 Lyle (1994) presented regenerative design for sustainable development which presents ecological design, regenerative practices for energy use, land use, water use, and building design.

The concept of industrial ecology (IE) got introduced in the book "Industrial Ecology" from 1995 by Graedel and Allenby (Graedel and Allenby, 2010). The concept of IE requires that industrial systems is viewed in concert with the surrounding systems, and seeks to optimise the materials, products and services in their life cycle. IE is the study of the means by which humanity can consciously and rationally approach and maintain a desirable carrying capacity, given continued economic, technological and cultural evolution (Graedel, 1996).

The concept of biomimicry was introduced in 1997 and is the practice that learns from and mimic the strategies found in nature to solve human design challenges (Benyus, 2002, Biomimicry Institute, n.d.). McDonough and Braungart (2002) presented cradle-to-cradle (C2C) where a design framework with benefits for the society from safe materials, water and energy in circular economies and eliminated the concept of waste. C2C is about redesigning and reshaping traditional product design. The C2C design concept recognises two cycles for materials, the technical and the biological cycle (McDonough, 2020). The performance economy was presented by Stahel (2010) and focused on delivering performance and services with less material input, dematerialisation, product performance

and sustainability. The blue economy was a concept from Pauli (2010) and this concept goes beyond the globalized and green economy. The blue economy is based on zero emissions research and initiative philosophy. The concept seeks to inspire entrepreneurs to seek solutions inspired by natures design principles. The blue economy aims to solutions engaging the local system of production and consumption and working with available local resources and adopting skills and the existing infrastructure accordingly (Waldegrave, 2017).

Geissdoerfer et al. (2017) define CE as a regenerative system in which resource input and waste, emission, and energy leakage are minimised by slowing, closing, and narrowing material and energy loops. This can be achieved through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishment, and recycling.

One of the newest definitions of CE is from the Ellen MacArthur Foundation. Ellen MacArthur Foundation (2017b) defines the concept of CE as a system that seeks to rebuild capital, whether this is financial, manufactured, human, social or natural. They divide the flows in the system in technical and biological materials. Figure 3 show the butterfly diagram of a CE.

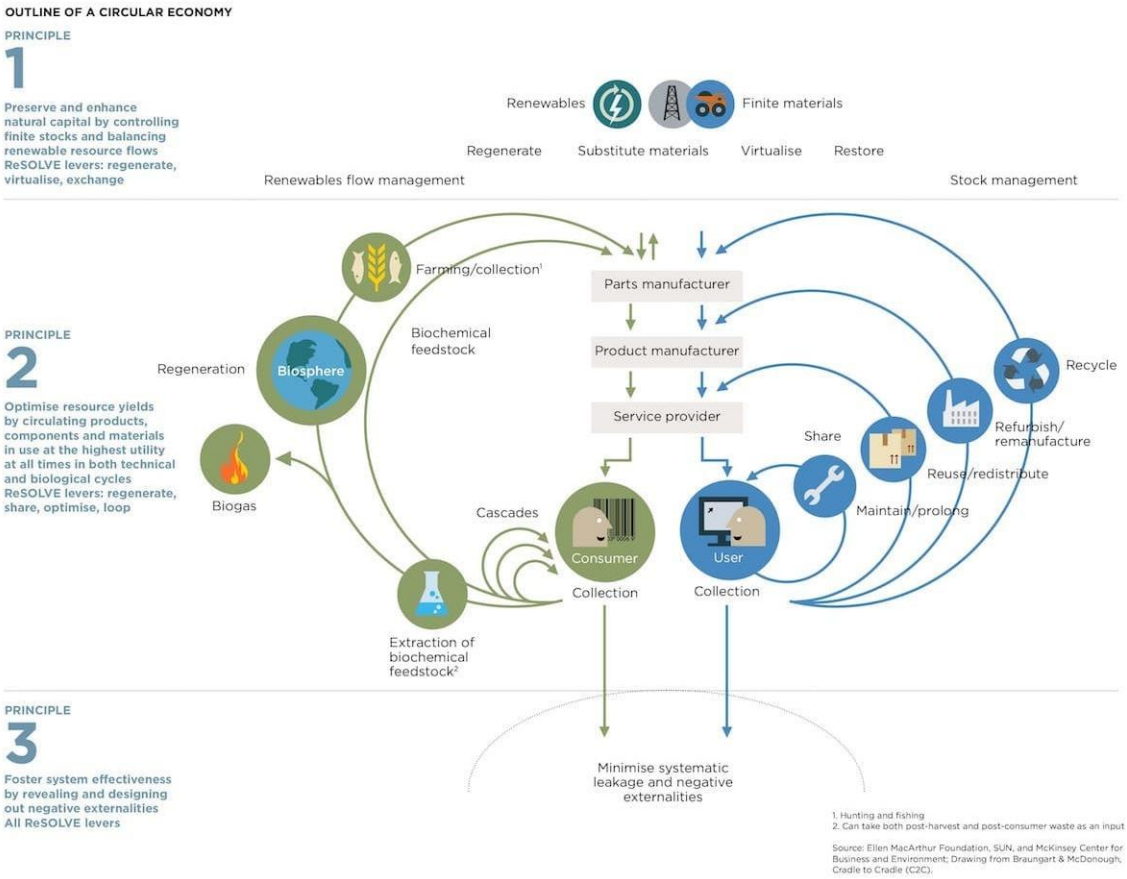

Figure 3: Butterfly diagram of the biological and technological loops in a circular economy. Retrieved from (Ellen MacArthur Foundation, 2017b).

According to Ellen MacArthur Foundation (2017a) the CE is based on principle of designing out waste and pollution, keep the products and materials in use, and regenerate natural systems. The Figure 3 show that the CE is seeking to minimise the systematic leakage and negative externalities. The system diagram illustrates the flows of biological and technological materials. The system diagram is basing both the biological and the technological cycles on the ReSOLVE framework. The ReSOLVE framework is based on regenerate, share, optimise, loop, virtualise and exchange. The regeneration is about shifting toward renewable energy and materials and returning the biological resources to the biosphere, restoring the ecosystems. Share is to share the assets, reuse and prolong the lifetime. Optimise is about increasing the efficiency and performance of a product and remove the waste. Loop is about recycling and extending the product lifetime. Virtualise is about dematerialise, deliver value without the need to materialise it as a physical asset. Exchange is the new technologies adopted, improving the way of producing goods and services (Ellen MacArthur Foundation, 2015).

3.4.1. Waste Management

The CE is about staying at a high level in the waste management pyramid. The waste management pyramid is presented in Figure 4.

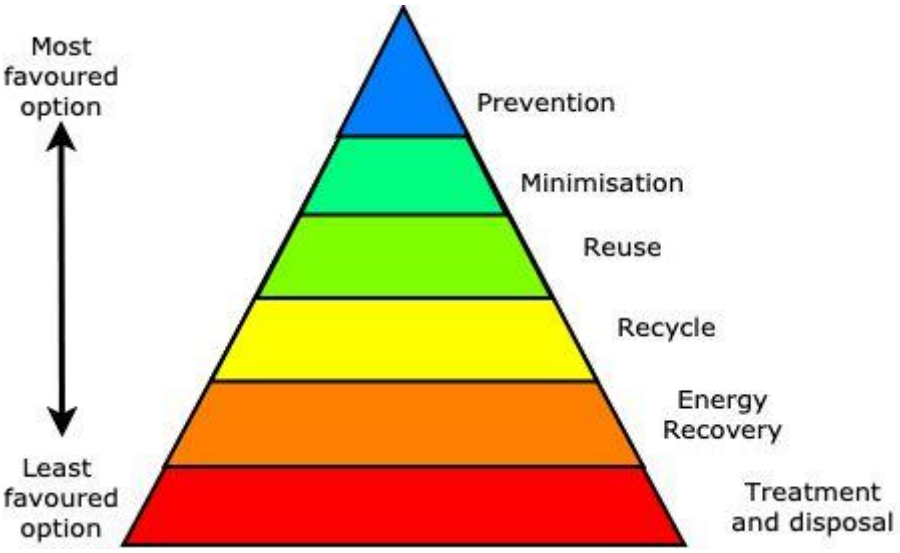

Figure 4: Waste management pyramid. Adopted from Hansen et al. (2002).

Figure 4 illistrate the waste management pyramid, and show that the most favoured option is to prevent waste and then minimise and reuse, before recycling and energy recovery, and the least favoured option is treatment and disposal of the waste. The CE aims at minimizing the waste and the emissions, and therefore aiming at the most favoured options in the waste management pyramid (Ghisellini et al., 2016)

3.4.2. Connection between sustainability and Circular Economy

Sustainability and CE are concepts that are widely used and often in similar context. The similarities and differences are rarely explicitly defined in the literature and this is making the lines between the two concepts blurry. Sustainability and CE has several similarities and differences and Geissdoerfer et al. (2017) found that in literature CE is viewed as a

condition of sustainability a beneficial relation or a trade-off. The similarities are found by Geissdoerfer et al. (2017) to be

- Intra and intergenerational commitment
- Global models
- Integrating non-economic aspects into development
- System change/design and innovation at the core
- Multi-/interdisciplinary research field
- Potential cost, risk, diversification, value co-creation opportunities
- Cooperation of different stakeholders necessary
- Regulation and incentives as core implementation tools
- Central role of private business, due to resources and capabilities
- Business model innovation as a key for industry transformation
- Technological solutions are important but often pose implementation problems

The overview provided in the list above show that both concepts are global and highlights the intra- and intergenerational commitments and underlines the importance of increasing agency for the multiple and coexisting pathways for development. The concepts use multi- or interdisciplinary approaches to better integrate non-economic aspects into development, which often includes that the main drivers for reaching their ambitions are system design and innovations. Different stakeholders are necessary for the concepts, and private businesses are among the most important stakeholders due to the capabilities and resources. Incentives and regulations play are important implementation tools for the concepts, and they both include potential costs, risks, diversification in distinct opportunities for value creation. Technological solutions are important, but business model innovation (BMI) is found to be the key pathway (Geissdoerfer et al., 2017). The differences between sustainability and CE are presented in Table 5.

Table 5: Selected differences between sustainability and Circular Economy. Adopted from (Geissdoerfer et al., 2017).

	Sustainability	**Circular Economy**
Origin of the term	Environmental movements, NGOs, non-profit and intergovernmental agencies, principles in silviculture and cooperative systems	Different schools of thought like cradle-to-cradle, regulatory implementation by governments, lobbying by NGOs like the EMF, inclusion in political agendas, e.g. European Horizon 2020
Goals	Open-ended, multitude of goals depending on the considered agent and her interests	Closed loop, ideally eliminating all resource input into and leakage out of the system
Main motivation	Diffused and diverse reflexivity and adaptive → past trajectories	Better use of resources, waste, leakage (from linear to circular)
System that is prioritised	Triple bottom line (horizontal)	The economic system (hierarchical)
To whose benefit?	The environment, the economy, and society at large	Economic actors are at the core, benefitting the economy and the environment. Society benefits from environmental improvements and certain add-ons and assumptions, like more manual labour or fairer taxation
How did they institutionalise (wide diffusion)?	Providing vague framing that can be adapted to different contexts and aspirations	Emphasising economic and environmental benefits
Agency (Who influences? Who should influence?)	Diffused (priorities should be defined by all stakeholders)	Governments, companies, NGOs
Timeframe of changes	Open-ended, sustain current status "indefinitely"	Theoretical limits to optimisation and practical ones to implementation could set input and leakage thresholds for the successful conclusion of the implementation of a Circular Economy
Perceptions of responsibilities	Responsibilities are shared, but not clearly defined	Private business and regulators/policymakers
Commitments, goals, and interests behind the use of the term	Interest alignment between stakeholders, e.g. less waste is good for the environment, organisational profits, and consumer prices	Economic/ financial advantages for companies, and less resource consumption and pollution for the environment

There are some differences between the concept of sustainability and CE as presented in Table 5. The concept of sustainability is older than the concept of CE. The concepts have different goals, the sustainability concept have multiple goals and the CE concept have closed loops as the goal. CE have better resource efficiency and better use of waste and emission leakage as the main motivation, and the sustainability concept have more diffuse motivation. The sustainable concept benefits the TBL and threat the three dimensions equally, and the CE benefit more for the economical actors that implemented the system and do not focus as much on the social dimension. Sustainability has a broader frame, and the CE emphasises economic and environmental benefits compared to a linear system. In agency there is also a difference, in the case of sustainability it is diffused and for CE it is

the government, companies and the non-governmental organisations (NGOs). The sustainability concept has an open-ended timeframe and can be reframed with time, and the CE concept has a theoretical limit to optimisation and practical ones to implementation could set input and leakage thresholds for the successful conclusion of the implementation of a CE. The concepts also are assumed to have different perception of responsibilities in the literature. In sustainability the responsibilities are shared, and in the CE concept it is private businesses and regulators/policymakers that have the responsibilities. The concepts also have different commitments, goals and interest included in the terms used in the literature. The sustainability concept focuses on the interest alignment between the stakeholders, and the CE focuses on the economic advantages for the companies and less consumption of resources and pollution for the environment (Geissdoerfer et al., 2017). In Table 6 the relationship between CE and sustainability is presented.

Table 6: Relationships between Circular Economy and sustainability. Adopted from (Geissdoerfer et al., 2017).

General direction	Type of relationship	Short description circularity/closed loop systems are seen as…
Conditional	Conditional relation	One of the conditions for a sustainable system
	Strong conditional relation	The main solution for a transformation to a sustainable system
	Necessary but not sufficient conditional relation	A necessary but not sufficient condition for a sustainable system
Beneficial	Beneficial relationship	Beneficial in terms of sustainability, without referring to conditionality or alternative approaches
	Subset relation (structured and unstructured)	One among several solutions for fostering a sustainable system
	Degree relation	Yielding a degree of sustainability with other concepts being more and/or less sustainable
Trade-off	Cost-benefit/trade-off relation	Having costs and benefits in regard to sustainability, which can also lead to negative outcomes
	Selective relation	Fostering certain aspects of sustainability but lacking others

The two concepts have relations that can be conditional, beneficial or trade-offs, as presented in Table 6. The conditional relation CE is described as conditional for sustainable development. In strong conditional relations circularity is considered necessary for a sustainable economic system. Another type of relation is that circularity is seen as necessary, but not sufficient conditional for a sustainable system. Beneficial relations present CE systems as beneficial for the sustainable dimensions, such as resource efficiency and job creation. In subset relation circularity is one among several solutions to foster the sustainability system. In degree relations circularity are considered to be more sustainable than most other concepts because they comprise more eco-innovation targets and mechanisms. This is a hierarchical view where the only exception is the Industrial ecology framework which is seen as more sustainable. Trade-offs are negative relations, and the cost-benefit/trade-off relation highlights that the costs and benefits of circularity can lead to negative outcomes. The selective relation highlights that the circularity has a

positive influence on some aspects of sustainability, but other aspects like the social dimension is not integrated (Geissdoerfer et al., 2017).

A review of the literature assessing circular metrics towards a sustainable development through CE was developed by Corona et al. (2019). The reviewed CE assessment frameworks was based on three methodologies: Life Cycle Assessment (LCA), Material-Flow-Analysis (MFA) and Input-Output Analysis (IO). The LCA, MFA and IO are tools used to determine which strategy that should be favoured, and whether the adaption of a circular strategy would increase the sustainability. LCA is a tool to assess the environmental impacts of products or services along the entire life cycle (Corona et al., 2019). MFA is a systematic assessment within a system defined in time and space. The system connects the sources, the pathways, and the intermediate and final sinks of the material (Brunner and Rechberger, 2004). Flows are measured in terms of their mass, this gives information about the quantity of materials used, but it does not state anything about the quality and the scarcity of the material. The main challenge is to acquire data and the data uncertainty, but due to the complexity the analysis can be used on every level (Corona et al., 2019). IO analysis was developed to describe the economic interdependence between different sectors, it has often been extended to also analyse the environmental and socio-economic impacts associated with activities in the different sectors. The tool has a top-down approach, and can also be used together with the other with LCA and MFA (Corona et al., 2019, Leontief, 1970). Corona et al. (2019) found in the review article that LCA was the most used framework to assess circular strategies. There are still some issues regarding how to regionalize the results or make them useable for a global level.

3.5. Industrial Ecology

Industrial Ecology is an approach that incorporates the dual perspectives of the products competitiveness and environmental interactions. It is an approach to the design of industrial products and processes. CE is in some sense the application of the fundamental industrial ecology metaphor to an entire economy (Graedel and Allenby, 2010). IE allows focus at the facility or firm level, at the inter-firm level and at a regional and global level, see Figure 5.

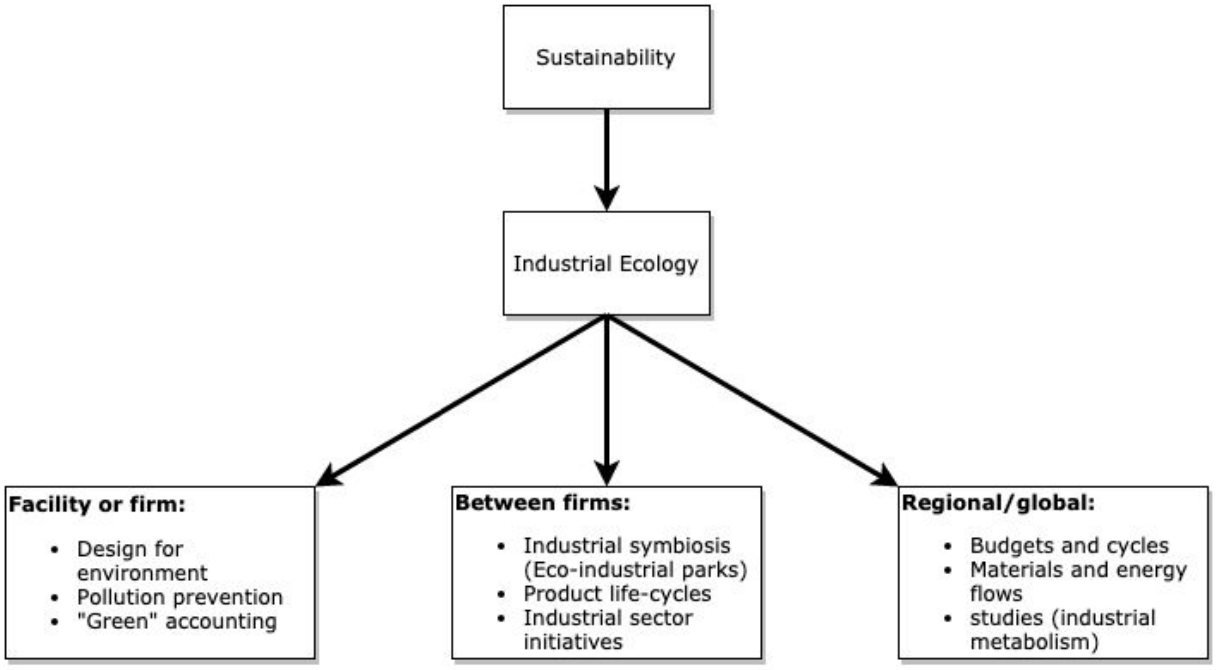

Figure 5: The three levels at which industrial ecology operates. Adopted from Chertow (2000).

3.5.1. Industrial Symbiosis

Industrial symbiosis occurs at an inter-firm level and the concept of industrial symbiosis is built on the concept of symbiosis in nature. Symbiosis is the intimate association of two species whereas one of them or both benefits. The concept of industrial symbiosis is when unwanted by-products of one industry can become new resources for another industry. Collaborative arrangements can lead to the development of industrial symbiosis. Three examples of collaborative arrangements are (1) utility sharing, (2) joint service provision and (3) by-product exchange (Chertow et al., 2008).

Industrial symbiosis would appear to offer the promise of developing environmentally superior industrial ecosystems (Graedel and Allenby, 2010). According to Chertow (2000) industrial symbiosis can be categories into five categories, (1) through waste management, (2) within a facility, firm or organisation, (3) among collocated firms in a defined industrial area, (4) among nearby firms not collocated, (5) among firms organized across a broader region. A high degree of synergy between input and output flows of resources in the system is key to an effective industrial symbiosis (Graedel and Allenby, 2010).

3.5.2. Urban metabolism

Urban metabolism is a concept that can be used in Industrial Ecology and was first proposed in 1965 by Wolman (1965). The concept is used to analyse the interrelations between the socio, environmental and economic factors in the urban area and hinterland (Broto et al., 2012). Kennedy et al. (2007) defines urban metabolism as the total sum of socioeconomic processes and technical processes that occur in cities, resulting in growth, production of energy and elimination of waste. Environmental footprint analysis can be used as a technique to examine the sustainability of cities by placing them in a broader

context. Communities requires input such as food, energy and other goods, and returns wastes and pollutants, Figure 6.

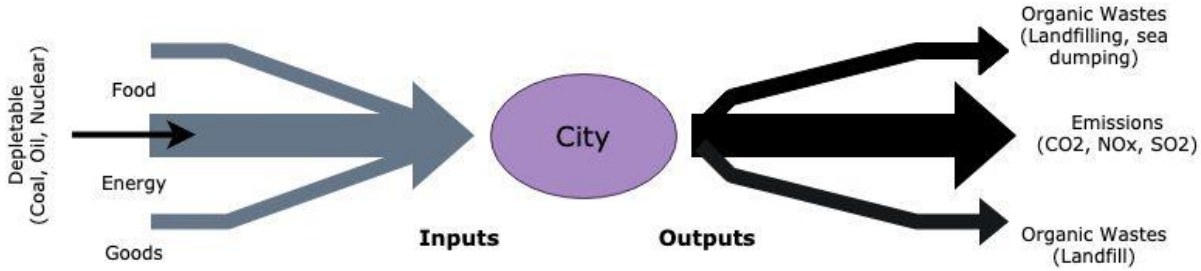

Figure 6: The linear urban metabolism. Adopted from Eaton et al. (2007).

The circular urban metabolism, Figure 7, minimises new inputs and maximises recycling.

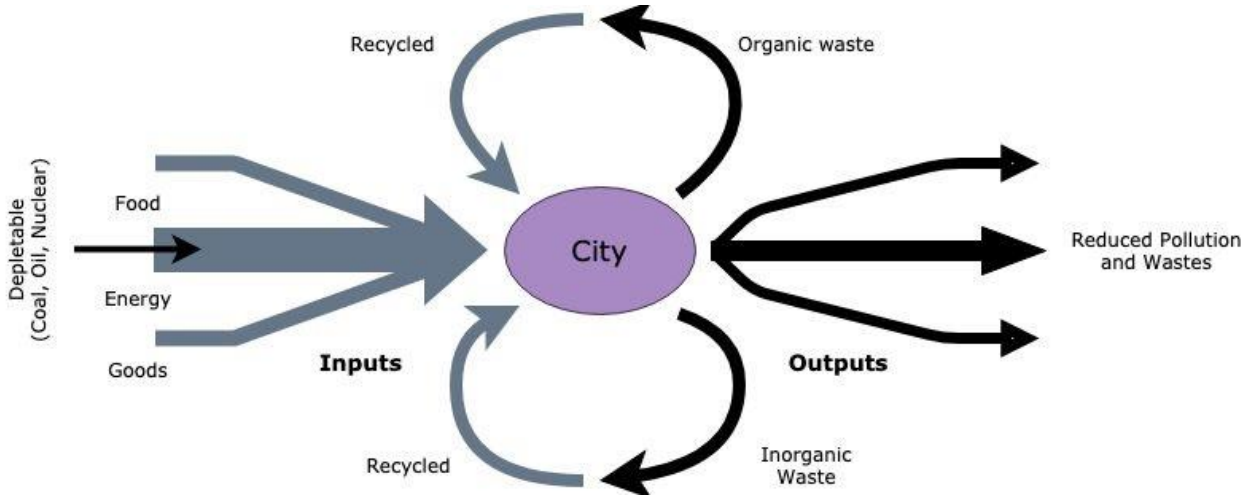

Figure 7: The circular urban metabolism. Adopted from Eaton et al. (2007).

3.5.3. Adaptive management

Adaptive environmental management is a natural resource management conducted in such a way that it purposely and explicitly increases knowledge (enhances learning) and decreases uncertainty. Adaptive management allows decision making to proceed despite present uncertainty (Holling et al., 1978, Walters, 1986). The aim is to reduce uncertainty over time, and optimise human-natural systems over time is of importance in adaptive management (Graedel and Allenby, 2010).

Five principles for management was suggested by Ludwig et al. (1993). (1) Include human motivation and responses as part of the system to be studied and managed, (2) act before scientific consensus is achieved, (3) rely on scientists to recognize problems, but not to remedy them, (4) distrust claims of sustainability and (5) confront uncertainty.

3.6. Business Models

Business model (BM) is the design and architecture of the value creation, delivery, and capture mechanisms of a business (Teece, 2010). A business model is the conceptual framework for how the company seeks to create profitability by offering and delivering value that is attractive to the customers and by charging customers in a way so the company is left with an acceptable profit (Jørgensen and Pedersen, 2015).

The economy today is strongly based on a linear economy, and as Kirchherr et al. (2017) concluded, CE must be understood as a fundamental systematic change. The minimal changes in current business models is not enough.

3.6.1. Business Model Innovation

Business model innovation (BMI) can be defined as a new configuration of what is done in the company, this is a new or improved system of activities required to the value proposition. Radical innovation and incremental innovations are built up and exploited in the new BM, improving the products, processes and organisation of the current BM. This provides options to applying and exploiting new technology and knowledge (Souto, 2015). Boons et al. (2013) found that BM is an important tool to understand and to make progress on sustainable innovation. The focus on BMI in relation to sustainability has increased over the last years. It has been researched which factors and what BM design that can help companies to achieve TBL-results (Foss and Saebi, 2016).

The transition to the low emissions society in entails many measures at three levels; efficiency, development and transition. A transition requires a multitude of processes and measures. The processes and measures will need to range from simple management mechanisms to more radical innovation with high demands on the processes and anchoring (Wang et al., 2018a). Figure 8 show the steering strategy to the low emissions society.

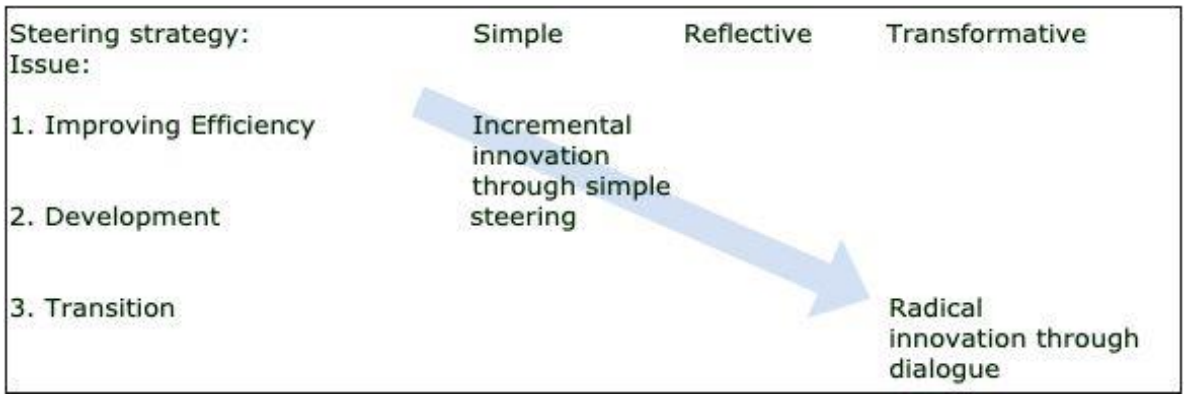

Figure 8: Steering strategy. Adopted from (Wang et al., 2018a).

A transformative transition to a low emissions society may demand BMI. As seen in Figure 8, improving efficiency is a relatively simple process and can be done through steering. Transition to a low emission society may need a radical innovation and as mention above

by Souto (2015) that radical innovation and incremental innovations can be exploited when innovating the BM.

3.6.2. Sustainable Business Models

Sustainable business models are organisational designs for value creation, value delivery, and value capture, where the company's reduction of negative externalities or promotion of the company's positive externalities, or both, are an integrated part of how value is created, delivered, and captured (Jørgensen and Pedersen, 2015). SBM includes the corporate social responsibility (CSR) as a part of their strategy ads value creation in the company (Geissdoerfer et al., 2018a). The transition from a business model to SBM to a circular business model (CBM) is presented in Figure 9.

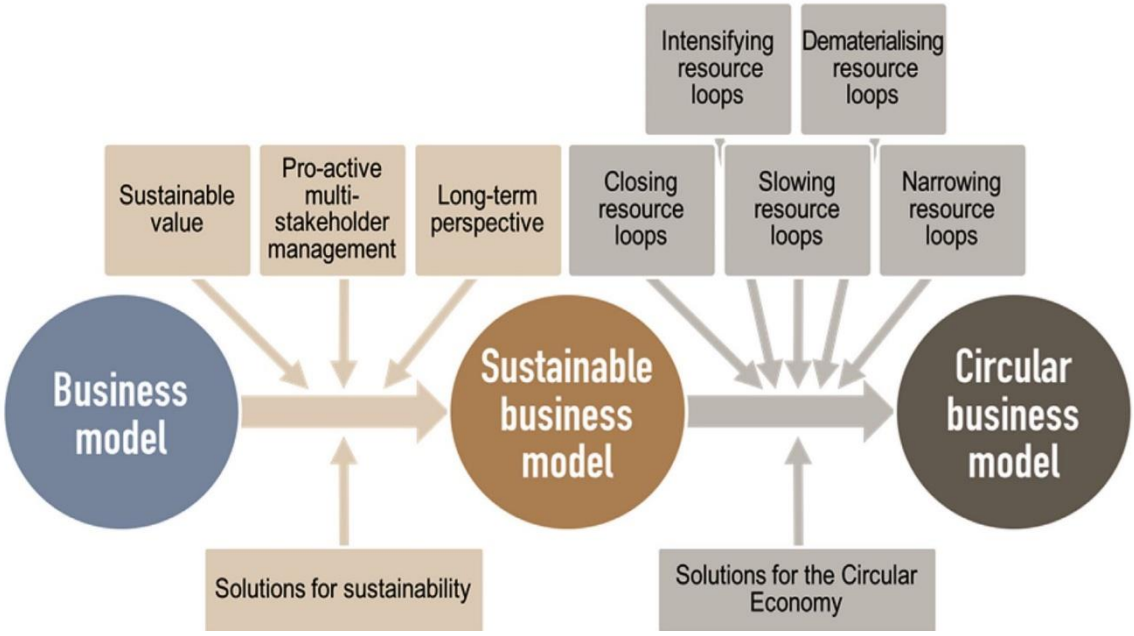

Figure 9: Sustainable and circular business models. Retrieved from (Geissdoerfer et al., 2018a, Geissdoerfer et al., 2018b).

The development from a business model towards an SBM includes solutions for sustainability, integrating the sustainable value, the pro-active multi-stakeholder management and long-term perspective.

3.6.3. Sustainable Business Model Innovation

Sustainability-oriented BMI incorporates sustainability principles as guidelines for BM design and adding complexity to the process of BMI (Pieroni et al., 2019). Jørgensen and Pedersen (2018) presents the RESTART framework of sustainable business model innovation. The RESTART framework intends to capture business models that captures sustainability and profitability at the same time. RESTART where R- Redesign, E – Experimentation, S- Service-logic, T – The circular economy, A – Alliance, R- Results, T – Three-dimensional. The businesses will have to redesign, which necessitates controlled experimentation and be characterised by service-logic. The business model needs to be based on ideas from CE which will make alliance more important. This will be important in order to achieve the right results.

3.6.4. Circular Business Models

The circular economic system is based on avoiding waste and trying to preserve the value of products as long as feasible (European Commission., 2014). CBM improves the sustainable performance of the company by minimising the resource inputs into and the waste and emission leakage out of the organisational system by closing, narrowing, slowing, intensifying, and dematerialising loops (Bocken et al., 2016). Nußholz (2017) defines a CBM as how a company creates, captures, and delivers value with the value creation logic designed to improve resource efficiency through contributing to extending useful life of products and parts by remanufacturing, prolonging the life-time through design, and repair, and closing the material loops.

Figure 9 in section 3.6.2. presents the transition from an SBM to a CBM, and as seen the transition from an SBM to a CBM includes closing the resource loops, intensifying resource loops, slowing resource loops, dematerialising resources loops and narrowing resource loops. The CBM includes an interest in being as high up in the waste management pyramid (Figure 4, section 3.4.1) as feasible.

Evolving from a linear value chain towards a circular value chain is based on changing the "take, make and dispose" way of thinking toward a repeatedly using way of thinking (Jørgensen and Pedersen, 2018). Thus, staying at a higher level in the waste management pyramid.

CBM are SBM that are specifically aiming at solutions for the CE though a circular value chain and stakeholder intensive alignment (Geissdoerfer et al., 2018a). Geissdoerfer et al. (2018a) argue that all three elements of a business model (value proposition, value creation and delivery, and value capture) must go circular to achieve optimal sustainability performance within the CE. CBM is becoming prominent in advancing the transition towards a circular economy (Nußholz, 2017).

3.6.5. Circular Economy Business Model Innovation

Research on CE-oriented BMI is more recent than the sustainability-oriented BMI research. The CE-oriented BMI have had a rapid growth the last years. CE-oriented BMI incorporates principles or practices rom CE as guidelines for the BM design, and aims at a more resource efficient use and ultimately closing the loops in the system (Pieroni et al., 2019).

3.7. Value creation in sustainable and circular business models

In conventional business model innovation, value is discussed and presented as value proposition, value creation and delivery, and value capture. Value proposition is the value that is offered to the customer through a product or a service. Value creation and delivery is the activities, resources, capability, channels and partners of the business. Value capture is the cost structure and revenue streams (Richardson, 2008).

Boons and Wagner (2009) finds that the relationship between ecological and economic performance takes different shapes depending on the system boundary that is examined. A CBM represents a holistic system of co-evolving managerial practices for collective value creation, delivery and capture, which provide solutions for sustainable development. No single theory or literature can explain value creation in a CBM (Ünal et al., 2019). Designing for biomimicry can be helpful to facilitate creating value. CE requires sustainable behaviour among the supply chain, regenerating natural waste through aligning managerial practices, sociocultural and socioeconomic settings. CBM provides robust opportunities for regional socioeconomic regeneration by co-creating shared value (Ünal et al., 2019). Recovery activities are mostly considered as a reverse supply chain activity, and value adding concepts from the forward- and reverse supply chain may leverage the process of value creation. The value creation can be classified into six subclasses, namely partnerships and collaboration, product design characteristics, service concepts, IT solutions, supply chain processes and organizational characteristics. In this way companies can create competitive advantages by closing the loop (Schenkel et al., 2015). Circular business models do not only has potential to be competitive with linear production practices but, if designed carefully, it can also provide superior customer value, significant environmental impact reductions, and value for network partners (Nußholz et al., 2020). A framework for value creation in CBM are developed by Haines-Gadd and Charnley (2019) and shown in Figure 10 below.

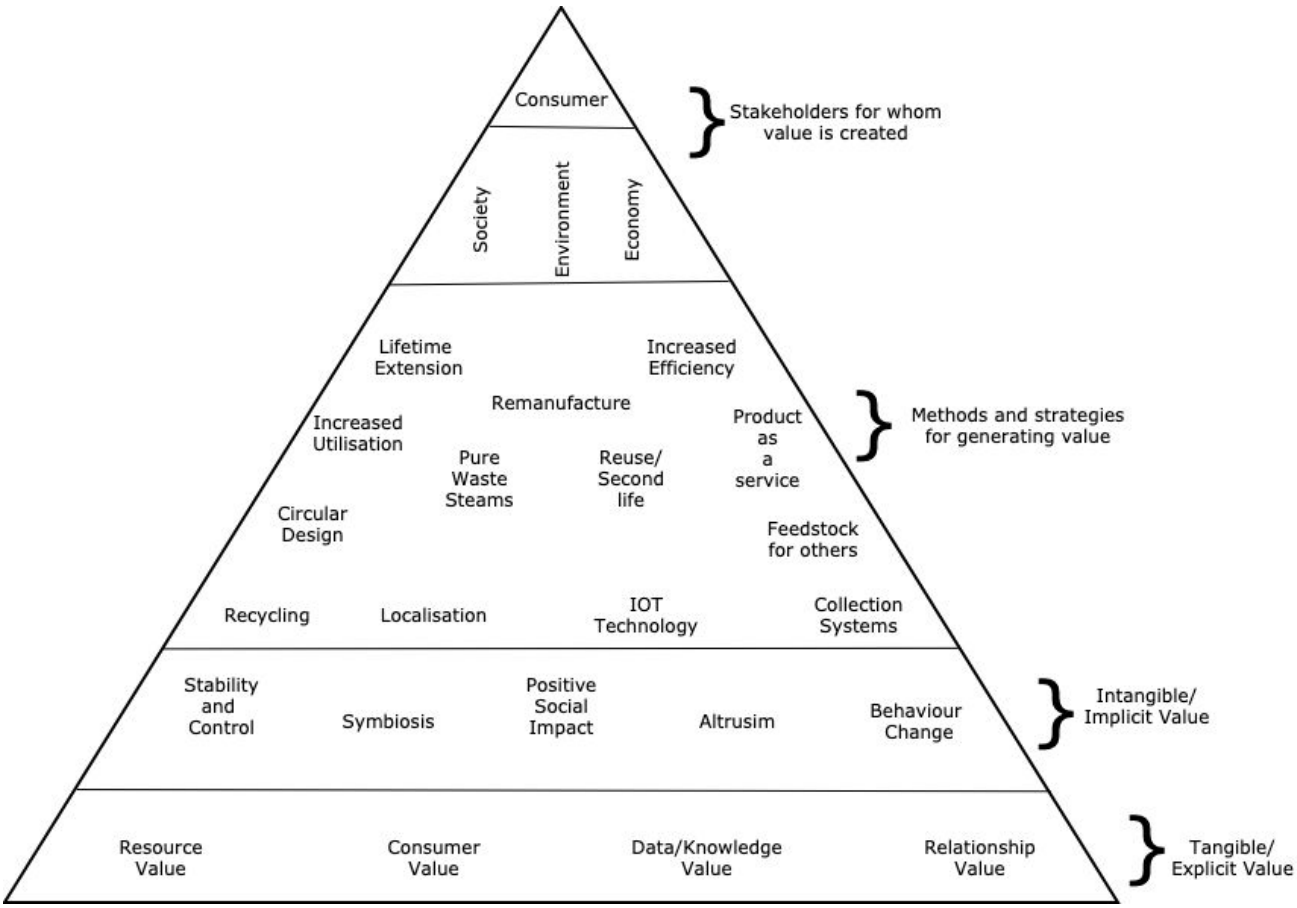

Figure 10: Framework for creating value in a circular business model. Adopted from (Haines-Gadd and Charnley, 2019).

The framework has a triangular form to represents the emergence of value creation from bottom to the top, whereby the most tangible, easily identifiable forms of value are located at the bottom, and the intangible values are above. The values are generated by the methods and strategies, and the value is delivered to the stakeholders in the top of the triangle.

3.8. Implementation of Sustainable Business Models and Circular Business Models

Business managers might find themselves in the trade-off between responsibility and profitability, and sustainable business models can help to differentiate the company either in the current market or in a new market. By reformulating its function, the company may also come into contact with other types of customers. From a strategic perspective the implementation of a SMB and CMB is about differentiate the company from the competitors. The management are focused on the sustainable business model innovation and circular business model innovation, and emphasise the value reorientations. There should be awareness about the reorienting, expectations and motivations and effort of both the companies employees and other stakeholders who contribute to the company's value creation, value delivery and value capture (Jørgensen and Pedersen, 2015).

4. Circular Economy Model

In this chapter the circular economy model will be presented. The model is divided into two models, one model to capture the leisure-related economy in a region with a holistic perspective, this is a model on a macro level. The other model is part of the macro level model, but is on a micro level, the model is for the buildings of cottages. The model is a simplification, but tries to capture the potentials of a sustainable and circular leisure-related economy. The model is built on principles from the theoretical resources, especially sub-chapter 3.4. about circular economy, sub-chapter 3.5. about Industrial Ecology, sub-chapter 3.6. about business models and sub-chapter 3.7. about value creation. The model for the leisure-related economy can be sees as an urban metabolism model including industrial symbiosis. The macro level model is called "circular economy model for the leisure-related economy" and is presented in the following section, thereafter is the micro level model "circular economy model for cottages" presented.

4.1. Circular Economy Model for a leisure-related economy

Based on the theoretical resources the circular economy model for the leisure-related economy are made. Figure 11 presents the model, and the explanation of the model is below.

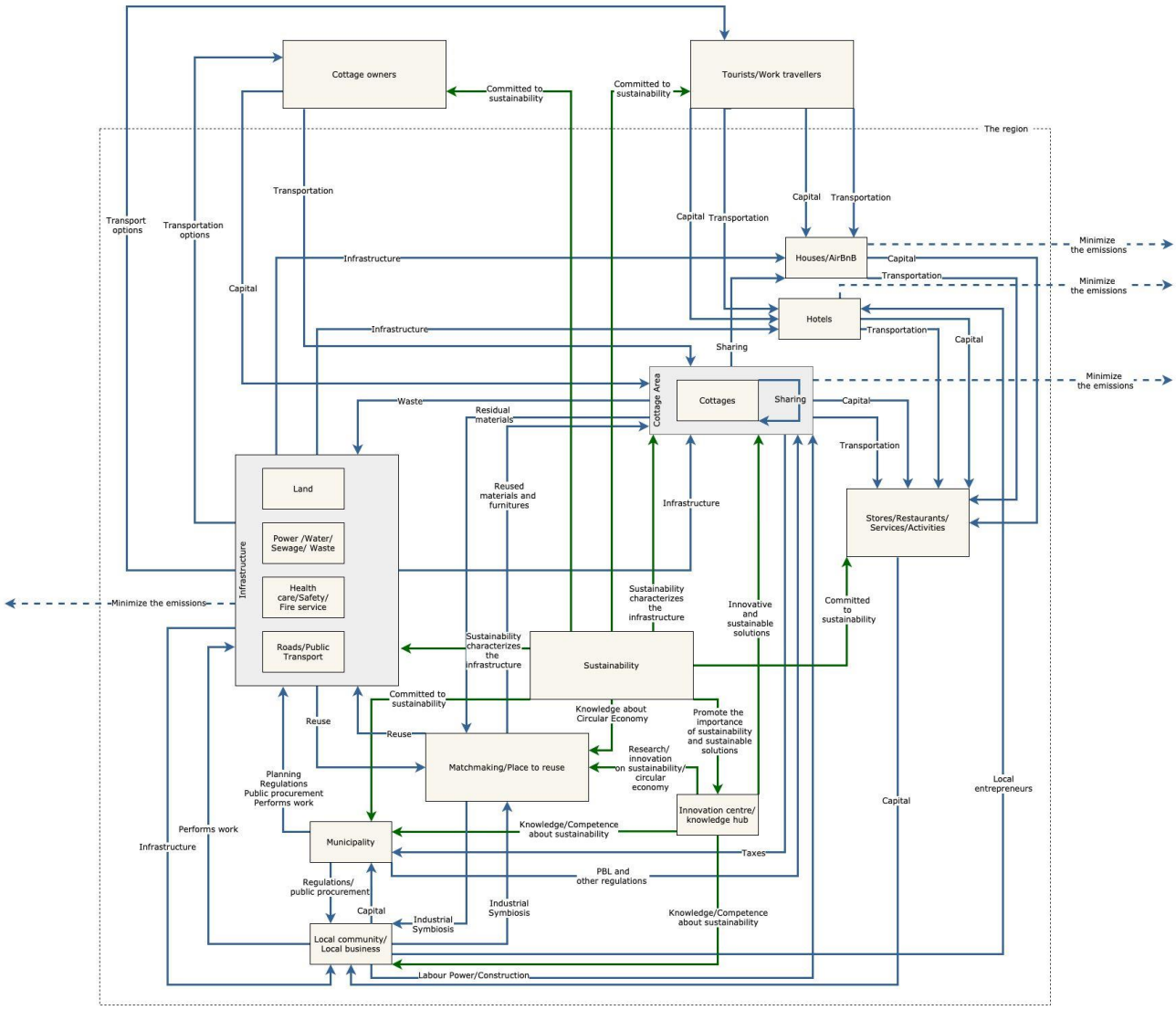

Figure 11: The circular economy model for the leisure-related economy.

The model has divided the leisure tourist into two categories, cottage owners and tourists/work travellers. This is done since the cottage owners and the tourists/work travellers have different patterns in their spending. The tourists/work travellers' travels to a destination. The transportation options are based of the infrastructure in the region they are visiting. The most sustainable option for mobility is hopefully chosen. The tourists/work travellers spend money on their place to stay which is usually a hotel, or renting a cottage/house through AirBnB. They are also spending money on stores, restaurants, services and activities, this increases the capital in the region.

The cottage owners choose a sustainable transport option provided by the municipality. The cottage owners invest in the cottages they are building, the investment increases the value creation in the region. This model aims at closing the loops, and therefore the labour power is local so the invested money in the cottages stays in the region. The cottage areas are regulated by the municipality. The strongest instrument for a sustainable cottage building is the regulations. The planning and building act (PBL) is an important legal instrument when it comes to the development of cottages since the law includes the land use planning. PBL requires the municipality to consider the climate when the planning and is therefore an important long-term instrument fir climate policy (Plan- og bygningsloven., 2008, Aurdal, 2019). To help municipalities, private consultants and other in the planning and development process of more environmentally friendly cottages there is a guide made called T-1450 from 2005 (Miljøverndepartementet, 2005). There is also made a report with input to the revision T-1450 where there is a greater focus on sustainability (Rambøll and Norsk TuristUtvikling AS., 2018). TEK17 is a regulation for building technicalities, and a new version from the previous TEK10. TEK 17 have requirements and guidance for building, the considerations of the environmental impacts. Regulation on technical requirements for construction works, TEK17, draws up the limit for the minimum features an building must have to be constructed legally in Norway (Direktoratet For Byggkvalitet, 2017).There are also other standards and more strict regulations that can be implemented in the building projects.

To have a sustainable development of the cottage areas, the model also implements shared use of the cottages. This can be done in different stages, such as cottages with shared facilities like storage, or cottages with shared kitchen and/or living room, or shared cottages so the cottage is used by multiple cottage owners. The sharing can also be done by sharing services, such as AirBnB.

The cottage owners use money on stores, restaurants, services and activities. This capital is then increasing the capital of the local businesses/ local community. The local businesses pay taxes to the municipality. The municipality are responsible for the infrastructure of the region. They are planning and regulating the infrastructure. The local businesses are then preforming the work of the infrastructure, but also receiving the common goods of using it.

Sustainability is implemented in every part of the model. The work with sustainability is crucial for a sustainable leisure-related economy. The investment in work with sustainability might increase the commitment to sustainability of the cottage owners, tourists/work travellers, the stores, restaurants, services and activities, the local businesses and local community, the municipality and thereafter incorporated in the

infrastructure of the region. The focus on sustainability will for example work towards increased public transport possibilities and bike options rather than cars. The focus on sustainability and circularity is working to minimise the emissions of the region.

The innovation centre/knowledge hub is researching sustainable solutions and knowledge to further develop med sustainability in the region. Sustainability is dynamic and has a need for innovation. Innovation and sustainability also need to be implemented in the business models in the region and an innovation centre/ knowledge hub can be of help for the businesses.

To increase the circularity in the region, a matchmaking/place to reuse is implemented. The businesses in the region can find by-products of each other to use. Waste for one company can be a resource for another company, there will be industrial symbiosis. A place to reuse can also be for the cottages, residual materials and furniture's can be reused by others to minimise the waste and creating a platform for reuse. When building the infrastructure, also residual materials can be collected and reused materials can be used.

4.2. Circular Economy Model for cottages

Based in literature on circular economy models there has been made a suggestion of a circular economy model for cottages (Figure 12). The model presented in Figure 12 is mostly based of Crowther (2005) and Ellen MacArthur Foundation (2017b).

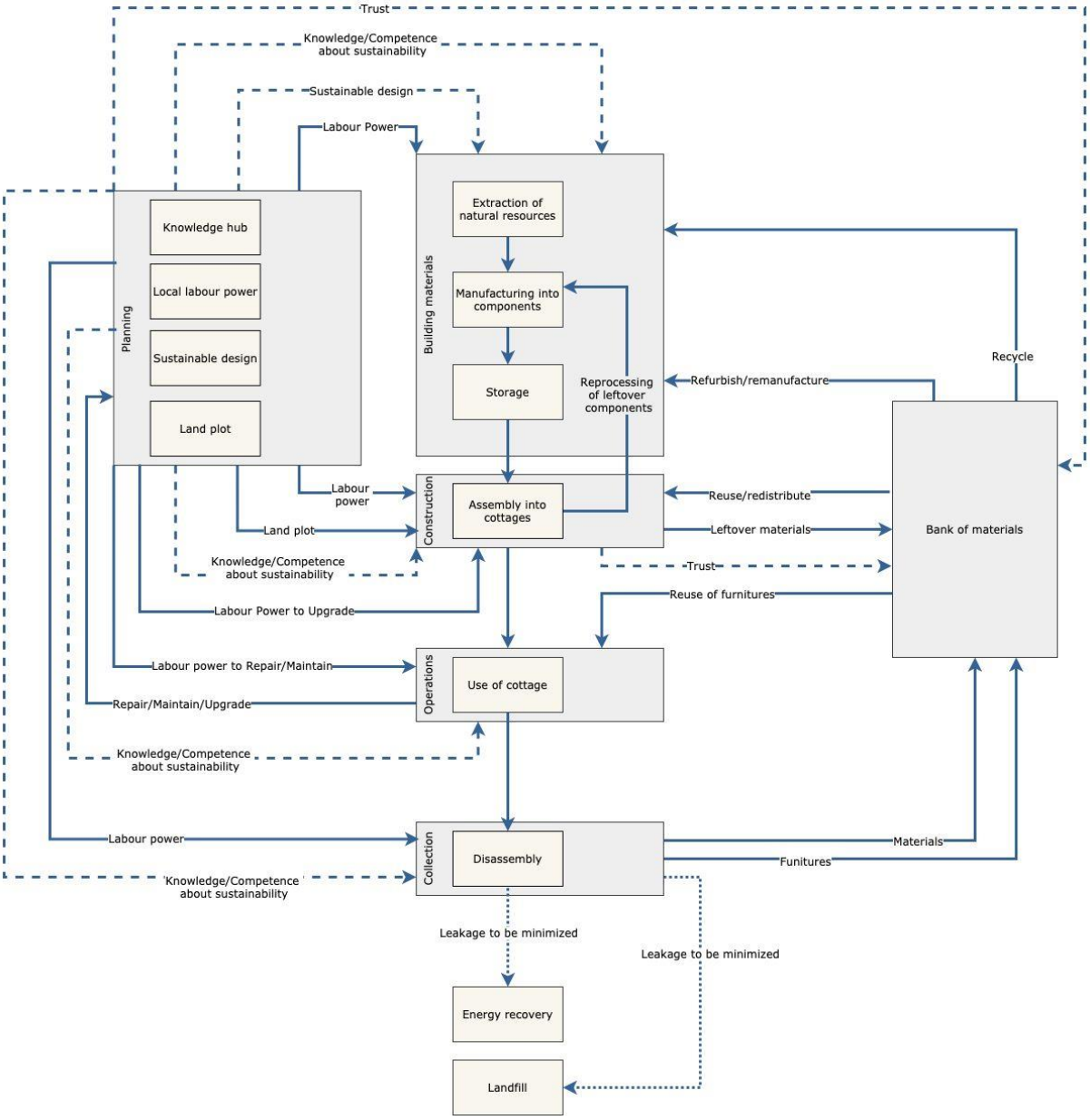

Figure 12: The circular economy model for cottages.

The model has a focus on the planning of building the cottages. For a circular cottage building, there is a need for planning. The knowledge about sustainability and circularity is crucial for the rest of the processes. The knowledge about the different materials that are being used on the building process and evaluation of the impact of each material. The cottages should be built on sustainable and circular design and competence. The cottages should be designed to use less materials, have environmentally friendly materials that have a lifetime extension and is design for easy reuse. To increase the value creation in the region, the model is building on local labour power, and the land owners sell land plots. These principles are based on the waste pyramid from section 3.4.1. and the methods and strategies in Figure 10 in section 3.7. by Haines-Gadd and Charnley (2019). The land used for cottages has an alternative cost which is important to consider. The land use can impact the biodiversity and is one of the reasons for the importance of considering new and more sustainable use of the cottage areas.

The building materials are depended on extraction of natural resources. The natural resources are being manufactured into components and then stored or used into cottages. The leftover components can be reprocessed into new components in the manufacturing phase. Leftover materials can also go into a bank of materials, and then be recycles, refurbished, remanufactured, reused or redistributed.

The bank of materials can be a physical place where the materials/furniture go, or it can be an online platform to connect the need for materials/furniture. The bank of materials is built on trust. The companies innovating their business model to a circular business model need to collaborate and then also trust each other. The knowledge and awareness in the market about the circularity and sustainability is important for value creation for creating a market for circular cottages and also for value creation in for the consumer.

When using the cottages, the cottages can take advantage of the bank of materials and reuse furniture. When needing to repair or maintain the cottage, the knowledge and competence about sustainability is important. The repair and maintenance of the cottages are increasing the value creation in the region.

Cottages have a long lifetime, and the disassembly of the cottages are for the future, but by planning that from the beginning, the leakage to energy recovery and landfill is minimized. The sustainable design and the knowledge and competence about sustainability makes the reuse of materials and furniture easy, and contributes to less leakage out of the system.

5. Empirical data

This section will present the main findings based on the interview, the workshop and the literature search done for the case study. The case study is as the model presented in chapter 4 divided into one macro level system and one micro level case. The macro level system is the leisure-related economy at Oppdal and a micro level system is a cottage producer called Lundhytta. The first subsection will present the leisure-related economy at Oppdal. In this section Oppdal as a leisure-related economy will be presented, the main industries there will be presented and the development of the cottages will be presented. In the second subsection the case of Lundhytta will be presented.

5.1. Macrosystem of Oppdal

Oppdal is the largest municipality of cottages north of Dovre (Engebretsen and Iversen, 2020). Oppdal is located at national parks like Dovrefjell, Forollhogna and Trollheimen. The destination has a lot to offer in both summer and wintertime. Oppdal is known for having a great offer to skiing enthusiasts with countless opportunities for cross country skiing and randonnée. The destination also has opportunities for hiking, biking, rafting, musk safari and great nature for nature-based activities and cultural experiences. Oppdal is a municipality where tourists, cottage visitors and business travellers accounts for a significant part of the value creation.

The tourist office, the marking of the hiking paths and the work with the cross-country skiing tracks are common goods that makes Oppdal a more attractive tourist destination and a more attractive destination for the cottage tourists. That Oppdal is a more attractive tourist destination is something several of the local businesses can use for the greater good. The common goods have the free-rider problem, and Oppdal as every other destination have this problem. Today there is no plan for the financing and the administration of the common goods. The permanent residents and the cottage owners pay a property tax, which is not specifically used to the common goods, but helps fund the costs of the municipality. Unlike the residents, the cottage owners do not have the right to vote and therefore has no influence on how the tax money should be used (Sandnes et al., 2013).

In 2015 Næringshagen Nasjonalpark published a survey of the cottage owners. In 2015 54,74% of the people owning a cottage at Oppdal are from Trondheim and area around Trondheim. 20,31% are from Møre, 6,58% from the area around Oslo, and the rest from other places. The survey found that the local consumption per person/day in 2015 is 526kr, and this was an increase from 154kr in 1999. There is an average of 3,3 people for each cottage with 57 days of using the cottage each year. The survey showed that the most important facilities for the users of the cottages are the nature, cross country skiing facilities, hiking trails, outdoor activities, the store facilities and the alpine resort. The survey also showed that the cottage owners are most satisfied with the grocery stores, the stores of sports and leisure products, the wine monopoly, the construction products. The products and services that the cottages owners are the least satisfied with are the internet facilities. The nature was the facility that the owners appreciated the most at Oppdal, and second most favoured facility at Oppdal was the cross-country skiing opportunities. The

property tax was the least favoured thing with Oppdal, and the second least favoured was the densification of cottages (Jystad, 2015).

The last 20 years there has been a development of cottages in the municipality, the numbers of cottages have more than doubled (Engebretsen and Iversen, 2020). The developments of cottages at Oppdal are one of the reasons why it is important to look at how the leisure-related economy and the cottages can become more sustainable. The Figure 13 to Figure 16 presents the development at Oppdal. Figure 13 presents the numbers of new build cottages from 1983 to 2019 at Oppdal. The figure show that there building of new cottages are increasing from 1083 to 2019.

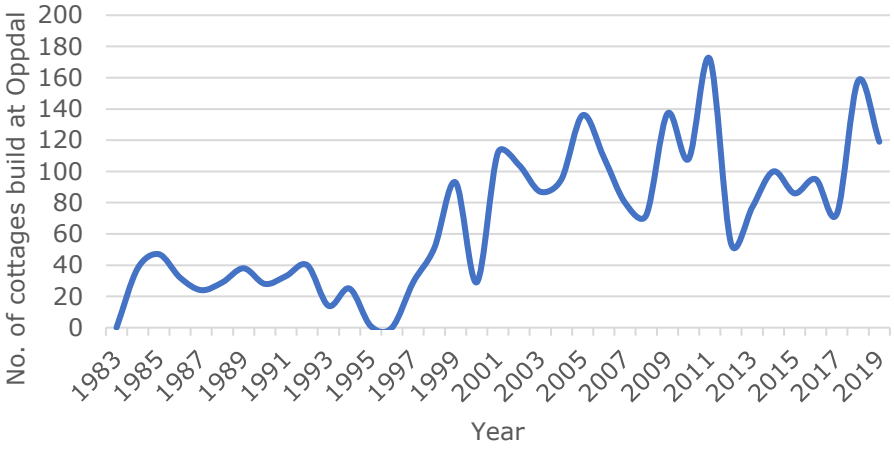

Figure 13: New build cottages at Oppdal from 1983 to 2019. Adopted from data from (Statistisk sentralbyrå, 2020b).

Figure 14 present the usable area of the cottages at Oppdal from 1983 to 2019. The usable area for the cottages has had an overall increased from 1983 to 2019 in Oppdal.

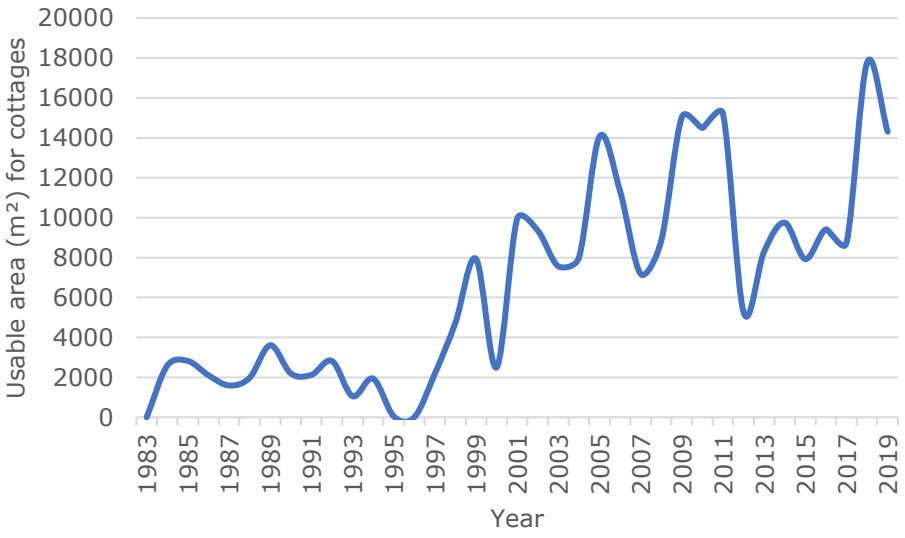

Figure 14: Usable area for cottages at Oppdal from 1983 to 2019. Adopted from data from (Statistisk sentralbyrå, 2020b).

The average usable area per cottage at Oppdal from 1983 to 2019 are presented in Figure 15 The usable area per cottage has increased from 1983 to 2019. There is a gap in the figures in 1996, and this is because the data from Statistics Norway (SSB) did not have any reported new build cottages in this year.

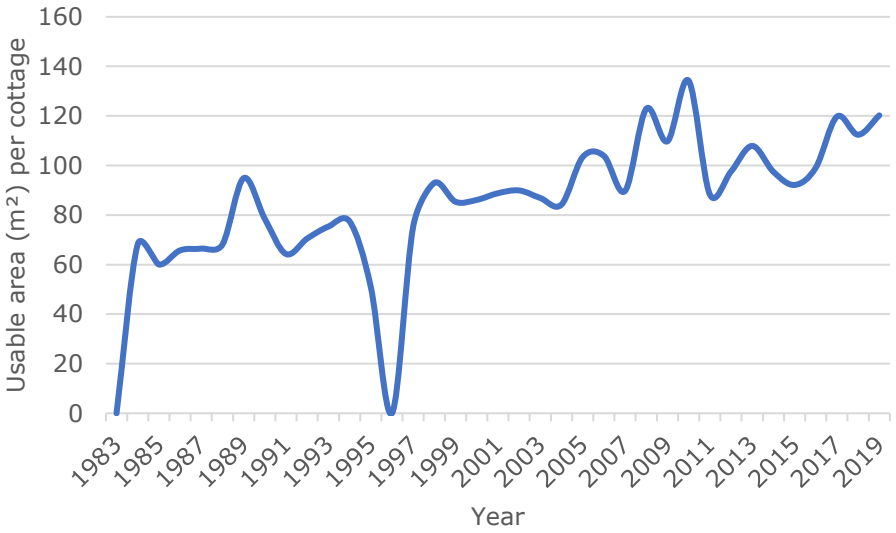

Figure 15: Average usable area per cottage from 1983 to 2019. Adopted from data from Statistisk sentralbyrå (2020b).

Figure 16 present the cottages per km^2 at Oppdal from 1998 to 2020. There has been an increase of cottages per km^2 at Oppdal.

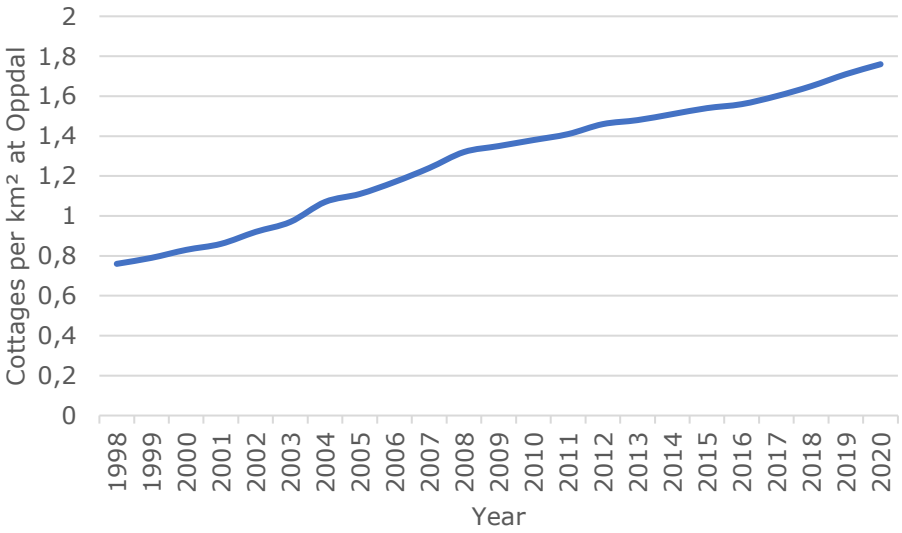

Figure 16: Cottages per km2 at Oppdal from 1998 to 2020. Adopted from data from Statistisk sentralbyrå (2020c).

As seen in Figure 13 to Figure 16 there has been an increase in the number of cottages, the size of the cottages and the density. Since there is a certain amount of land that can be regulated to cottage areas, this development cannot continue forever. The cottage development requires large natural areas and this affects the animal and plant life which also need to be considered. The increased density of the cottages is also one of the least

favoured things the cottage owners have to comment about Oppdal, and therefor this increased building can be problematic in the future. The cottage owners still need to feel like the product they bought, which is the cottage, is the product they get. Oppdal has many local construction companies that are building cottages, but the activity of building cottages is so high that the national companies are also largely used. The national companies are more generalise, used fewer local workers and their value chain is usually not local, so a lot of the value creation in the building of the cottages leaves the municipality with the national companies.

Tourism and cottage owners are important for maintaining the employment at Oppdal. In 2018 their consumption made the foundation of 660 jobs in the leisure-related business sector at Oppdal. Around half of the jobs where found in accommodation and dining. There are some seasons, holidays, weekends and evening that have a higher demand and it is therefore common to bring in seasonal workers from other places of the country or from abroad. In 2020 there was a report of the value creation and the ripple effect of tourism in Oppdal. Tourist living at hotels leave more money in Oppdal than the cottage owners, but the cottage owners uses the local stores, and in the construction, maintenance and upgrading of the cottages the local services and construction industry are often used. The local businesses are not the only ones that increases their revenue by the cottage owners spending, the municipality increases their revenue due to the property taxes that the cottage owners need to pay (Engebretsen and Iversen, 2020).

Since the early 2000s, the hotels in Oppdal have a decline in the demand for accommodation and have therefore had a declining capacity utilization. Since 2016 the capacity utilization has been steady at 40%. The cottage development has increased the last 20 years. Since 2016 the number of days where guests have used Airbnb in Oppdal have increased from 1700 in 2016 to 22000 in 2019, this is a growth of 1200%. The work travellers are the ones that uses the most money, 1650 NOK a day, and this is mainly due to high expenses on accommodations. Holiday travellers and foreign travellers all spend over 1000 NOK a day. The cottage tourists spend 280 NOK a day, but if the investments, the maintenance and the upgrading of the cottages are included the daily spending is 665 NOK (Engebretsen and Iversen, 2020).

Tourists have a significant consumption in the retail trade. Tourists leave 145 million NOK in this industry in Oppdal. The grocery stores are design for a larger number of consumers than the population would indicate, which makes sense considering that there are more cottages than houses in Oppdal. In 2018 the tourist's consumption in the tourist industry at Oppdal was the foundation for a value creation of around 175 million NOK, and 270 million NOK if the value creation in the building, maintenance and upgrading cottages are included (Engebretsen and Iversen, 2020).

5.2. Microsystem of Lundhytta

Lundhytta is a construction company from Oppdal, they deliver cottages and houses, but mostly cottages. In 1980 they were a logging company that supplied semi-finished products to the consumer and the consumer completed the construction. Today they

provide ready-to-move-in cottages. The owners of Lundhytta also have a company called "Grønn Fritid" with some other companies and landowners where they are working with green leisure-time, and sustainability (Lund, 2020).

Lundhytta have their own production and warehouse for storage of the components. They buy raw materials and produces a lot of the components themselves. They produce elements for the wall, roof and terraces in the workshop, and mount the components at the construction site. They have carpenters, but they also hire some local carpenters. Not all carpenters want to work for just one company (Lund, 2020).

Lundhytta is member of a national procurement partnership that has agreements with manufacturers throughout the country. Some of the products come from central factories in Norway and some come from abroad. Materials purchased through the purchasing collaboration may be such as plate products and windows. 70-80% of the unput factors to Lundhytta us are from areas relatively close to them. Constructional wood comes mainly from Støren. Interior panel comes from a local manufacturer from Meldal. Kitchens that are going into the cottages are almost without exceptions from Foss Snekkeri in Meldal. There is more and more awareness about using local products (Lund, 2020).

It is the raw building that requires the largest volume of materials, but the wages for for the employee that is the largest single cost for Lundhytta. This goes together with that the employees are their most important resource. The sales of cottages are their most important income, and the sales of land plots are also part of the income, they are here collaborating with some local landowners (Lund, 2020).

In 2019, they founded a new company "Grønn Fritid" where they own 1/3 of the company. It is important that this should be based on knowledge and experience, and that it should be economically viable, good land use planning, take biodiversity into account and the environmental impact. They are also working with Næringshagen Nasjonalpark to develop more sustainable concepts for cottages. "Grønn Fritid" is working on a whole new cottage concept at Nerskogen with a great focus on sustainable solutions. The goal is to lay the foundation for a sustainable cottage culture in which a cottage yard consisting of ten small cottages and common areas will be prepared. This project focuses on how thirty families can be part owners of this cottage yard, as well as how to make the concept attractive and environmentally friendly. They look into the possibilities with increased sharing and what common functions that can be revealed. They want to develop a model that has less environmental footprint, which can solve several problems around the development of cottages (Lund, 2020).

They also work with Grønn Fritid to find other methods for founding. Cement-based foundations are one of the worst when it comes to CO_2 emissions. It is difficult to cut concrete completely out of the building process, but it can be minimized. Lundhytta and Grønn Fritid have a pilot project that is about doing a foundation without concrete. Currently, concrete is still being used on regular cottages, but there is more awareness

around the use of concrete and the associated environmental impact. The biggest effect of replacing concrete will be when it is incorporated into the regular recreational buildings. The concrete used today comes from Rennebu (Lund, 2020).

The most important residual materials come from wood, this is due to the cut-offs when cutting the wood and waste from production. There is also a part of the waste that is from packaging. When windows are delivered, they come with wood around them and plastic. They come on a disposable pallet. There is also packaging around the wood. The residual materials are collected in containers and a local environmental company at Oppdal picks it up. Most of the wood is sent to Sweden for the production of district heating (Lund, 2020).

There is around 100 - 150 cubic meters of wood waste per year. The wood waste is picked up in containers, but they get a lot of air in the container. Around 1 container of 8-10 cubic is collected a month. Packaging of plastic and cardboard / paper are handed in to the environmental company. The plastic is recycled. They do not know what happens to cardboard / paper. These are much smaller quantities then of wood waste, about 10-20 cubes of each. The drywall is an environmental hazard and there is a desire to find a replacement. The drywall is picked up by the local environmental company. This is about 10 cubic meters a year. There is a new factory in Norway that produces wood fiber boards instead of drywall, and there is an opportunity to use these instead of drywall in the future (Lund, 2020).

Lundhytta is very concerned with sustainability and sustainable and green business development. They notice that the market is two-fold. Young people with good finances are more concerned with sustainability and CO_2 footprint than many of their older customers. Lundhytta believes that sustainability will be a fundamental requirement to bring in the future and they are willing to invest in sustainability (Lund, 2020).

6. Results and analysis

This section will present the information from the empirical data incorporated into a system based on the model made in chapter 4. The first section is presenting the system of the leisure-related economy put into the model, and a sub-section of the circular economy potential in the leisure-related economy. This is an analysis where the actual system is compared to the circular economy model for the leisure-related economy. Then the next section is presenting the system of Lundhytta, and a subsection with the analysis of the system compared with the circular economy model for cottages. The third section is a SWOT analysis of the case study. The SWOT analysis is divided into Oppdal as a leisure-related economy and Lundhytta as a producer of cottages. In the fourth section there will be presented an analysis of the connection between the circular economy model and the case study and the SDGs. In the last section in this chapter the initial research questions are reviewed and answered.

6.1. System analysis of the leisure-related economy

In this section the leisure-related economy described in chapter 5 is incorporated into a system made based on the model developed in chapter 4, and then the system is analysed.

6.1.1. The leisure related system of Oppdal

The system based on the model in chapter 4 is presented in Figure 17, and an explanation of the system is below.

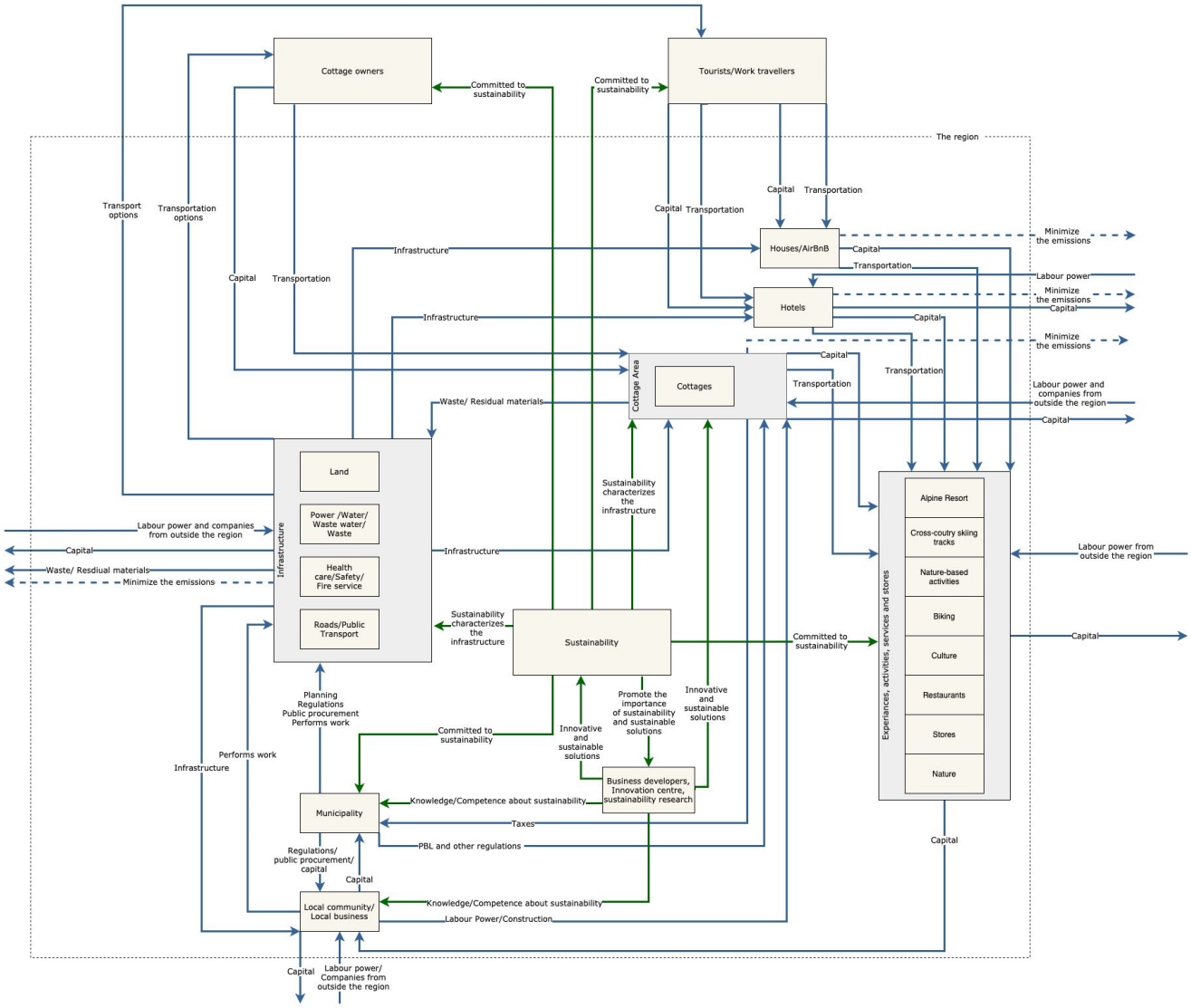

Figure 17: The leisure-related economy in Oppdal.

The cottage owners come from outside the municipality and they bring capital into Oppdal when they buy land plots and build cottages there. In order to have a cottage area the municipality need to regulate areas for the cottages, and can use the PBL and other regulations, they also need to provide the community with the necessary infrastructure. The community and the cottage areas need to have power supply, water supply, waste water, a plan for the waste, health care, police, fire rescue service, roads and public transport options. The provision of quality water and sewer system in regulated areas would also contribute to minimising the pollution from the use phase of the cottages (Velvin et al., 2013).

Oppdal has the option to use train to go to Oppdal, but the cottage owners usually go to their cottages by car. The use of car to the cottages has a larger environmentally impact than using the train (Dybedal and Farstad, 2012). The cottage owners use many of the attractions, services and stores at Oppdal. They need transport options to get there, and since many uses car to go their cottages it is assumed that they also use the car to go to the attractions, services and stores. Oppdal have a wide range of activities and the cottage

owners spend money on a lot of them, which makes the local community and the local businesses earn money. The local businesses and the local community pay taxes to the municipality. The municipality are planning the infrastructure, they are regulating the land use, they are responsible for public procurement, and they also perform work. When the municipality need to improve the infrastructure, the local businesses can perform this work and then again earn money. The local community and the local businesses are then also using the infrastructure and the infrastructure makes it more attractive to travel to Oppdal, thus this is a common good.

The tourists and the work travellers stay at hotels or use Airbnb. They also have different transport options. They pay for their stay and spend money on activities, food, restaurant, and other experiences and stores, and this money are then going to the local businesses and the local community.

Nasjonalparken Næringshage are one of the companies that are working a lot with sustainability. Another company is Grønn Fritid. There are several companies that work with sustainability, green tourism and a sustainable leisure-related economy. There are several new and innovative projects connected with sustainability at Oppdal that these companies are working with, such as "Grønn Fjellhageby". There is coming a new innovation centre coming in 2021, where one of the things that are coming there is a co-working space and an innovation lab.

The nature in Oppdal and the surrounding environments are important for the cottage owners and the tourist. Therefore, the protection of the area and the work with sustainability is important for them also. The infrastructure is regulated and also need to be in thread to a sustainable development, and need to protect the nature and the wild life.

Waste and residual materials, are send out of the municipality. The companies that do work on Oppdal and it not located there or uses local labour power take the money they earn out of the region again. There are some big companies that build cottages that are not located in the region, and the same with some of the labour power, especially in season-based sectors.

6.1.2. The potential circular leisure-related economy of Oppdal

Oppdal is working with sustainability, but can work to improve even more. They have several companies that are working with sustainability in the cottage business sector, such as Nasjonalparken Næringshage and Grønn Fritid. When analysing the macro level system of Oppdal compared to the model made for a circular leisure-related economy there are several aspects that can be improved to become more sustainable and circular. To analyse the macro level system of Oppdal there an alternative system including some of the aspects from the model in section 4.1. are made, and the alternative system is shown in Figure 18 below.

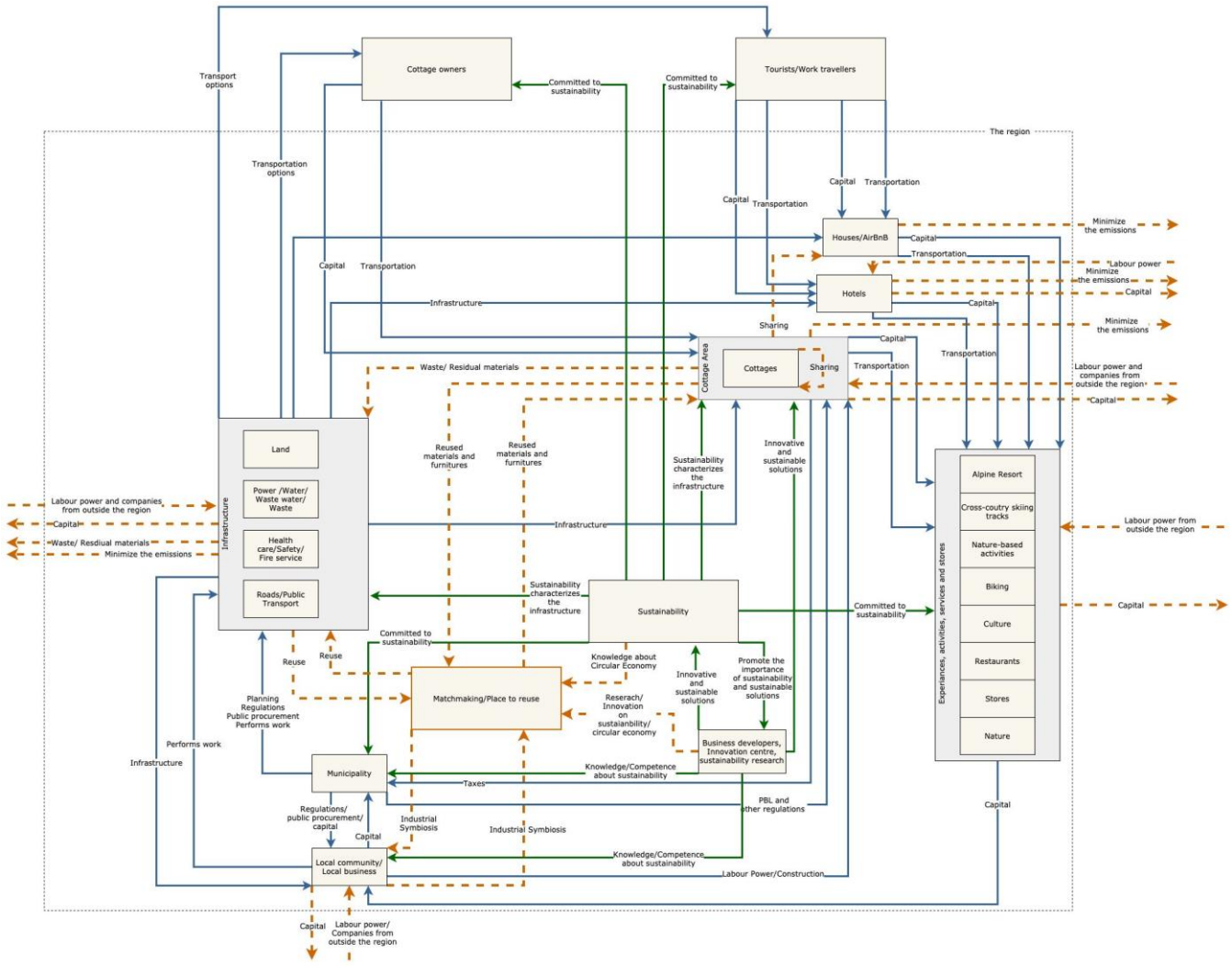

Figure 18: Potential of implementing a circular economy model in the leisure-related economy.

Oppdal can work to be more sustainable and circular. They can minimize the emissions from both the transport options and the cottage areas. The cottages areas will be more specific analysed in the system analysis of Lundhytta in section 6.2. below. To become more sustainable and minimizing the negative environmental impact the public transport options need to be improved. As Dybedal and Farstad (2012) examined, the car is a travel option that creates pressure on the infrastructure and have a negative environmental impact. The creation of an improved public transport option would also create some new jobs in the region making.

The system in Figure 18 are a system where sharing is more incorporated, than in Figure 17. The cottages have potential of being shared more, there was some suggestion of methods to share the cottages described in section 6.2.2. By using environmentally friendly options to travel and sharing cottages more, there is potentials of reducing the increased land used for cottages and the environmental impact from the building of the cottages and the traveling. The leisure-related economy also has the potential for using more local labour power to increase the value created in the region and minimising the value going out of the region. The capital going into the region impacts the whole region, due to the

ripple effect. The investments in the region may affect the stores, the restaurants, the services, the activities, the local businesses, the local community and the municipality.

Potential of implementing a matchmaking/place to reuse in the leisure-related economy in Oppdal are also present. Finding industrial symbiosis can provide the businesses with both environmental and economic benefits. IE can exist in different ways and one way to categorise them is as Chertow et al. (2008) did, divided into three categories, (1) utility sharing, (2) joint service provision and (3) by-product exchange. The businesses can share location, share storage, share services or one business's waste is another business's resource. There is also potential for the cottage owners and for the building infrastructure to reuse. The focus on sustainability and the work done with sustainability is already incorporated in the leisure-related economy in Oppdal, but there is potential for even further implementation of the circular economy principles, but as Jørgensen and Pedersen (2015) presented, there should be awareness about the reorienting, expectations and motivations and effort of both the companies employees and other stakeholders who contribute to the company's value creation, value delivery and value capture when implementing a sustainable and circular business model.

The research and innovation in the region are important factors for the development of the leisure-related economy. The research on circular economy may contribute to more awareness in the local businesses and for the cottage owners and tourists/work travellers. The research and innovation on sustainability and circular economy may also contribute to new and better solutions, new more environmentally friendly substitute materials for the existing materials in use and overall, more knowledge on sharing, preventing, reusing and recycling. The implementation of this model can thus be a contribution to staying high in the waste pyramid, contributing to a more sustainable development in the leisure-related economy. An adapting management style and the incorporation of Ludwig et al. (1993)'s five principles for management could help implementing the circular economy model, it may help them actors managing the natural resources and deal with the uncertainties by using the previous knowledge to make decisions (Holling et al., 1978).

6.2. System analysis of Lundhytta

In this section the information about Lundhytta, described in chapter 5, is incorporated into a system made based on the model developed in chapter 4, and then the system is analysed.

6.2.1. The system of Lundhytta

The system is based on the empirical data and the model in chapter 4 and is presented in Figure 19, and an explanation of the system is below.

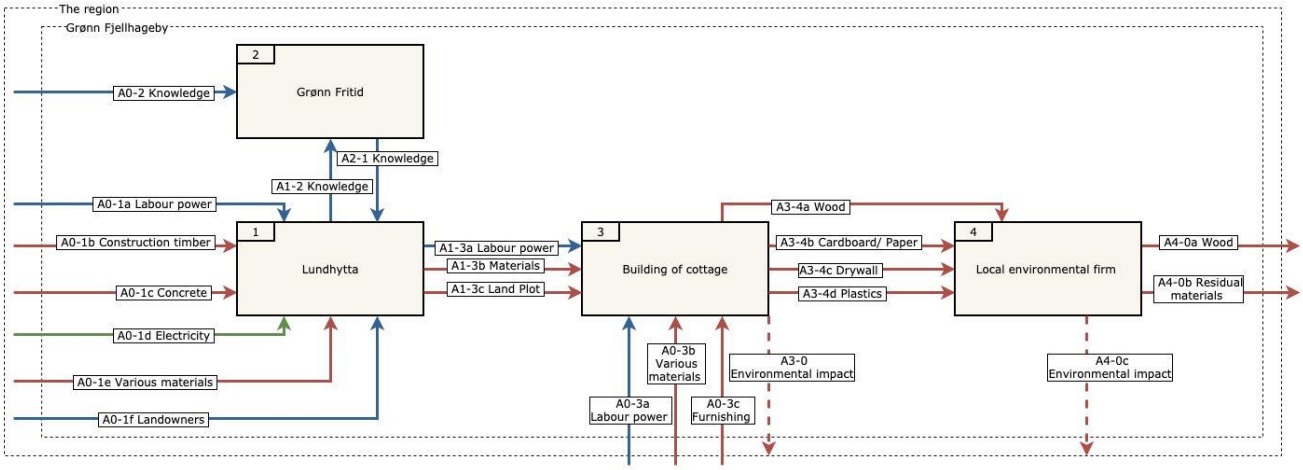

Figure 19: The system of Lundhytta.

The system is divided into Lundhytta which is the more planning stage of the system, then the building of cottages is the phase where the cottage is build, and then the local environmental firm is collecting the residual materials from when building the cottage. The Grønn Fritid is incorporated as a knowledge hub. Table 7 show the flows in the system more detailed.

Table 7: The flows in Figure 19.

					Flows			
From	**To**	**Note**	**Flow Name**	**Unit**	**Mass**	**Energy**	**Competence**	**Comments**
0	1	A	Labour Power	-			x	
0	1	B	Construction timber	-	X			
0	1	C	Concrete	-	X			
0	1	D	Electricity	-		x		
0	1	E	Various materials	-	X			
0	1	F	Landowners				x	Agreement with landowners
0	2		Knowledge	-			x	
0	3	A	Labour Power	-			x	
0	3	B	Various materials	-	X			
0	3	C	Furnishing	-	X			
1	2		Knowledge	-			x	
1	3	A	Labour Power	-			x	
1	3	B	Materials	-	X			
1	3	C	Land Plots	-	(x)			
2	1		Knowledge	-			x	
3	4	A	Wood	cbm	100 – 150 (yearly)			
3	4	B	Cardboard/Paper	cbm	10 - 20 (yearly)			
3	4	C	Drywall	cbm	ca 10 (yearly)			
3	4	D	Plastics	cbm	10 – 20 (yearly)			
4	0	A	Wood	-	X			Transported to Sweden, and used to district heating.
4	0	B	Residual materials	-	X			

As Table 7 show, there are relatively big quantum of wood that is transported to Sweden and used to district heating. The cardboard/paper and the plastics are also some containers during a year. This company is already working with sustainability and their willingness to incorporate sustainability gives the opportunity to incorporate even more sustainable strategies in their business model and also circularity.

6.2.2. The potential circular Lundhytta

The system of Lundhytta, Figure 19 in section 6.2.1., show that there are residual materials going out of the region and as explained in the description of the case in section 5.2. that at least some of it, such as, the wood is transported out of the region. The alternative system drawn in Figure 20 present an alternative way of dealing with some of the materials. The dotted lines are the flows that need to change from the original system. This system is based on the circular economy business model proposed in section 4.2. The goal is to have a closed loop of a system by trying to stay at a high level in the waste pyramid (Ghisellini et al., 2016) and thus minimise the use of natural resources and reuse, redistribute, refurbish, remanufacture and recycle as much as possible within the region.

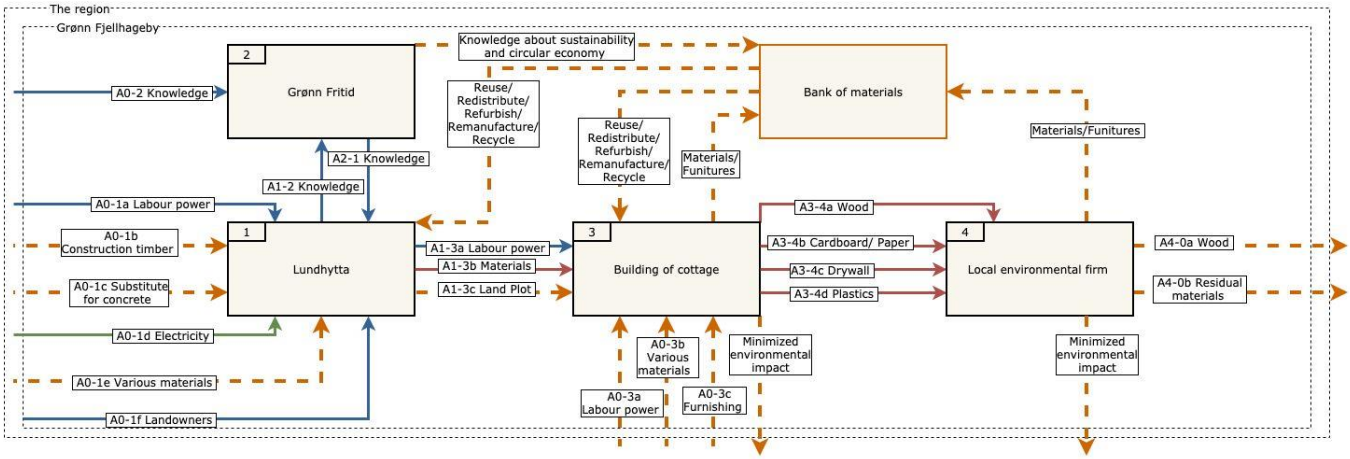

Figure 20: Potential of implementing a circular business model in Lundhytta.

In a circular economy and industrial ecology perspective, one of the great strengths of Lundhytta is their work with sustainability. The knowledge from the work in Grønn Fritid would give them knowledge on how to reuse as much as possible, and how to implement a CBM in the best possible way for the company.

There is also a potential for Lundhytta to find IE. They have residual materials, storage and labour power which other companies would be interested in. The companies need to build trust to each other as the model in chapter 4 suggested. The dotted line A0-1c is a substitute for concrete, it is supposed to be a material with less environmental footprint than concrete. If the materials with the most environmental footprint gets substituted the business are going into a more sustainable business model. The aim of the reuse, redistribute, refurbish, remanufacture and recycle of the bank of materials are that the input into the system of resources like construction timber and other various materials are minimized. This is coherent with the ReSOLVE framework and CE definition developed by Ellen MacArthur Foundation (2015). This gives the company a potential to incorporate and implement a circular business model as their business model.

There is potential to use more local labour power in Oppdal and thus increase the value creation in the region and contributing to an even bigger ripple effect. The local businesses can expand their businesses, and contribute to turning the development that Arnesen and Teigen (2019) found, that local companies lose the competition to the larger companies, and thus affecting the value creation in the local community.

The flow A1-3c "land plots" have potential of being minimised, to contribute to less use of land. More concentrated cottage areas tend to lead to economic sustainability, and long-term socio-culture and ecological sustainability, by giving access to social and cultural services and at the same time protect the nature (Velvin et al., 2013).

6.3. SWOT analysis

In this section a SWOT analysis will be conducted. The SWOT analysis is divided in two, one that has an environmental perspective and one that have an economic perspective. The two SWOTs are conducted on the leisure-related economy in Oppdal in the first sub-section, and in the second sub-section for Lundhytta.

6.3.1. Oppdal

The leisure-related economy at Oppdal are depended on the nature to attract tourist. It has strengths and weaknesses, opportunities and threats connected to this. Table 8 present a SWOT of the environmental factors, and then Table 9 present the economic factors. The strengths of the leisure-related economy at Oppdal in an environmental perspective is that they are aware that there need to be done something with the development of the cottages in the area. They are working with sustainability and want to be more sustainable. The innovation centre that is being built show that they are willing to invest in innovation and finding new solutions, which can help them be more sustainable. Nasjonalparken Næringshage and other firms such as Grønn Fritid are working with sustainable solutions for the businesses in the region. The project they have on a new and more sustainable cottage solution based on shared economy show that Oppdals leisure-related economy have an environmental strength in their already motivation for being sustainable and innovative. It is possible to go to Oppdal by train, which is a more environmentally friendly option than car or buss.

The bad public transport connection in Oppdal and to the cottages are a weakness with their leisure-related economy, which also makes the cottage owners to usually use their car.

The opportunities of the leisure-related economy at Oppdal are many. They facilitate a better public transport option at Oppdal and to the cottage areas. The new innovation centre gives more option for the leisure-related economy. The innovation centre can give new opportunities to share thoughts about the sustainable development at Oppdal and how to continue the development of cottages in a more sustainable way. The is also opportunities related to a more shared economy at Oppdal. The cottages can be shared,

or have shared facilities. This can be done by continue to work and implement the pilot project of the cottages at Nerskogen (section 5.2.). There are also opportunities to stay at a higher level in the waste pyramid. This can be done by more focus on sustainable design to minimize the use of materials and then to also keep the materials in the system for a longer time, and make it easier to reuse. There is also the opportunity to further develop destination do spread the pressure on the nature.

The ecological threats of the leisure-economy on Oppdal is associated with non-sustainable use of the nature which could lead to biodiversity loss. This is due to the cottage areas, the extensive use of the nature and the nature-based activities that can interfere with the natural habitat of species. Pollution into the air due to the use of cars to the cottages and to the different activities, services and stores at Oppdal are also an environmental threat. The land that is used for cottages have an alternative cost, and the land could have been used for agriculture or the soil could have been conserved. The cottage owners and tourist also put an extra pressure on the infrastructure, since it is additional use of the infrastructure, which can be a threat.

Table 8: SWOT-analysis of the leisure-related economy in Oppdal, an environmental perspective.

Environmental		
	Strengths	**Weaknesses**
Internal	• Aware of the situation • Working with sustainability • New innovation centre • Nasjonalparken Næringshage • Cottages are regulated into cottage areas • Possible to go to Oppdal by train	• Bad public transport connection at Oppdal • Cottage owners usually uses their car
	Opportunities	**Threats**
External	• Facilitate more public transport at Oppdal • The new innovation centre • Facilitate more co-sharing of cottages, storage and tools • Have a bank of materials and furniture to reuse - be a circular economy • Sustainable design • Further develop nature destinations - use more of the nature to get the pressure of some destinations	• Biodiversity loss • Pollution in the air • The alternative cost of the land used for cottages • Sustainable use of the nature • Not conserving the soil • Pressure on the infrastructure

The economical strengths of the leisure-related economy at Oppdal is that they have a lot of different facilities for the tourist and the cottage owners. They have many local companies that contribute to the development of the leisure-related economy and uses local labour power. Nasjonalparken Næringshage is working with development of businesses in the region. Oppdal is relatively close to Trondheim, Møre and also have E6 close, so it easy for tourist, cottage owners and work travellers to go there. Oppdal have great nature and as this was one of the goods the cottage owners were most happy with, this is also the main sales pitch for the cottages development and why the tourist should come. The increased amount of work travellers is also a strength for the leisure-related economy since it sends a message that the industry in Oppdal is interesting, it also may work as a way to put Oppdal on the map as a great destination to visit.

The economical weaknesses of the leisure-related economy are that there is a limit for how many cottages that can be regulated, and until now the number of cottages has increased the last 20 years, so the development is not sustainable. Many of the cottages are empty parts of the year and this makes the money spend in Oppdal less than it would have been if the cottages have people there continuously. There is also a decreasing amount of people that are staying at hotels, the hotel guest uses relative a lot of money each day they stay so this becomes an economic weakness. The increased intensity of cottages was one of the things the cottages owners was the least happy about, and if that continues this can make the value of the cottages less and make it less attractive to build new cottages in Oppdal which will have affects for many actors in the leisure-related economy.

Make the cottages have more days of use so the utilization of the cottages is higher is an economic opportunity. AirBnb have already had a high increase the last years in Oppdal, and this could be an option to rent out the cottages more. If the cottages owners are willing to contribute to renting out the cottages this would also make it possible to have a wider market of tourists and making it possible for the ones that do not have the possibility to buy or build a cottage at Oppdal to still be able to be part of the leisure-related culture. To focus more on sustainability are also an economic opportunity, sustainability is important to preserve the nature at Oppdal which is a reason for people to have cottages there and visit. Sustainability is also something people are more and more aware of and focuses on, so being a leader in sustainable leisure-related economy may make Oppdal more attractive. The principles of circular economy can also be an economic opportunity since it aims at making the resources stay in the region for a longer time. For this to be an economic opportunity there might need to be a change in how the businesses operate, but this can contribute to new work places. The resources need to be decoupled from the value creation, contributing to a green growth (Sandberg et al., 2019). The innovation centre that is coming have a co-working space which can make it more attractive for work travellers to come and also for cottage owners to stay longer in their cottages. The development of municipal services can also be an economic opportunity due to the availability to go to Oppdal and to stay there.

The economic threats to the leisure-related economy in Oppdal is competitor destination such as Trysil and Åre in Sweden. The people that would pay to go to Oppdal can choose to go to other mountain destinations and then there will be less money input to the leisure-related economy in Oppdal. The development of the cottages especially with regards to the density of the cottages are a threat is if it makes it less attractive to buy cottages at Oppdal and that will also affect the rest of the leisure-related economy. One of the big strengths with Oppdal is the nature, so overuse of the nature is a threat for the economy as it would be less attractive to go there.

Table 9: SWOT-analysis of the leisure-related economy in Oppdal, an economic perspective.

Economic		
	Strengths	**Weaknesses**
Internal	• A lot of facilities • Many local companies • Nasjonalparken Næringshage • Close to Trondheim, Møre and E6 • The nature resources • Increasing amount of work travellers	• There is a limit for how many cottage areas there are • Many of the cottages are empty parts of the year • Decreasing amount of people staying at hotels • Increased density of cottages
	Opportunities	**Threats**
External	• More utilization of the cottages - more days of use a cottage • Focus on sustainability • The material bank to reuse and make the materials stay in the system for a longer time • The new innovation centre and co-working space making it more attractive for work travellers • Development of municipal services	• Other mountain tourist destination, such as Trysil and Åre • The increasing density of the cottages can make it less attractive to buy and build cottages in Oppdal • Overuse of the nature - the nature is the strength of Oppdal

6.3.2. Lundhytta

Lundhytta is working with the building of cottages and have strengths and weaknesses, opportunities and threats connected to this. Table 10 present a SWOT of the environmental factors, and then Table 11 present the economic factors. The ecological strengths are that they are local, and they use local work power and this leads to less travel distances which leads to less environmental emissions from travelling. Since they are locals they also care about their neighbourhood and want to preserving it the best they can. They have a lot of experience and have been building cottages for many years, which gives them experience in how to build in a sustainable way. They work a lot with sustainability and on innovative solutions on how to reduce the environmental footprint from the cottage building. They are interested in investing in sustainable solutions and they work to find environmentally friendly materials to substitute the materials used today. They manufacture many of the elements for the cottages themselves and can store them in their own storage which gives the possibility to do just-in-time delivery and also to custom make all the elements to reduce the cut-offs.

The environmental weakness of Lundhytta is that they do not base their business on a circular business model, and there are materials that could have been kept in the region and reused or recycled in the region. It is a company and is basing their business on profit. The environmentally friendly options may be more expensive, at least in the short term, and then it is a trade-off between profit and the environment. There are also some of their resources that is not locally produces, which is an environmental weakness due to the environmental footprint of the transport.

There are environmental opportunities for Lundhytta, such as implementing a circular business model. They are already doing a lot of work with the choices of materials and the design of the cottages, but they could reuse more. This could be done by having a material bank to send the materials and if there is furniture that could be used again. The material bank could be used by just Lundhytta, but it could also be a collaboration with the other

companies that are building cottages. They can also work with sustainability in their value chain by demanding EPDs and environmental certifications for the suppliers. Another ecological opportunity is to work further with the project Grønn Fjellhageby to find sustainable solutions for the cottages, and also to implement the innovative cottage in the pilot project of Grønn Fritid in all the cottages built. To be a leader in sustainable cottages would be an ecological opportunity.

The environmental threats are the large companies that do not work that much with sustainability can affect the ecological system at Oppdal. Environmental innovative research can be costly and Lundhytta need to earn profit.

Table 10: SWOT-analysis of Lundhytta, an environmental perspective.

Environmental		
	Strengths	**Weaknesses**
Internal	• Local • Make many of the components themselves • Have their own storage and can have just-in-time delivery. • Experience • Innovative • Work with sustainability • Uses local partners • Use and develop more environmentally friendly materials to substitute other materials	• Not circular and do not reuse • Is a company and needs to earn profit and the environmentally friendly option can be more expensive on the short term • Not everything is local in their supply chain
	Opportunities	**Threats**
External	• Be circular - use a bank of materials and furniture • Project "Grønn Fjellhageby" • Working on innovative projects with their company "Grønn Fritid" • Be a leader on sustainable cottages • Check the sustainability in the value chain	• Large companies that do not work that much with sustainability • They need to earn money

There are some economic strengths of Lundhytta. They have experience and this also gives them a good reputation and people might have a higher willingness to pay. They use local partners which makes them contribute to the leisure-related economy in Oppdal. Local partners are also built on trust and trust between the partners are important for good results. Their work with sustainability is part of the cottage they sell, and as sustainability is more and more important this is an incentive for people to buy cottages from Lundhytta. They own large part of their value chain and have their own storage and are therefore less depended on other suppliers when building a cottage.

The economic weaknesses for Lundhytta is that it is relatively costly on a short term to be innovative. They are a relatively small company for building cottages. They are depended on the market for cottages and they are depended on Oppdal being an attractive destination to build cottages.

The economic opportunities are that they could work to get a bigger share of the market. They work a lot with sustainability and could use this to gain more market power and

making them an attractive cottage supplier. Their work with innovation can give them great opportunities for economic advantages. They can implement a circular business model to use more reused materials, this could be an advantage because they need less new resources and because it would show their work with sustainability.

The economic threats are the larger/national companies that are building cottages and that they can take the market share from Lundhytta. The regulations of land plots used for cottages could be slowed down or in an extreme situation it could be stopped, and then this would be an economic threat to the business.

Table 11: SWOT analysis of Lundhytta in an economic perspective.

Economic		
	Strengths	**Weaknesses**
Internal	• Experience • Local partner • Work with sustainability • Large parts of the value chain are self-owned • Have their own storage	• Costly on a short term to be innovative • Relatively small • Depended on the market • Depended on Oppdal being a attractive destination to build cottages
	Opportunities	**Threats**
External	• Be circular - reuse - use a material bank • Get a larger share of the market • Get known for their work with sustainability • Work more on local sustainability • Innovation can give opportunities	• Larger/national companies • New regulations/stop or slowing down on the regulations of land plots

6.4. Connecting the SDGs with the Circular Economy for the leisure-related economy including the cottage building

To make better decisions and set more efficient policies, the interactions between the SDGs should be identified. The trade-offs and the synergies should be identified. SDG 12 is one of the SDGs that are found to be most directly linked to CE and is therefore chosen to further investigation. All the SDGs would be interesting to investigate, but the SDG 12 will be used as an example on how it is done.

The scoring analysis show that there are more enabling, reinforcing and indivisible than neutralizing or restricting interactions. The score most often allocated is +1. As a result of this, CE in the leisure-related economy makes the achievement of other SDGs possible. The detailed investigation of the SDG with the other SDGs are presented in the appendix, A.5. SDG Interactions.

An analysis of how CE in the leisure-related economy contribute to the chosen SDG targets and some of the SDG indicators that is assumed to measure the contribution to achieving the SDGs are presented in the following sections.

6.4.1. SDG 8 - Decent work and economic growth

The most relevant targets for the leisure-related economy including the cottage building are target 8.4 and 8.9.

8.4. Improve progressively, through 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation, in accordance with the 10-year framework of programmes on sustainable consumption and production, with developed countries taking the lead (UN, 2015).

8.9 By 2030, devise and implement policies to promote sustainable tourism that creates jobs and promotes local culture and products (UN, 2015).

The transition into a circular economy will help the leisure-related economy to decouple economic growth from environmental degradation. The goal is having a green growth in the economy rather than a degrowth to maintain an economic sustainability. The implementation of the circular economy model in the leisure-related economy could contribute to more sustainable consumption and production. If more resources are held at a higher level in the waste pyramid by reuse, this will contribute to reduction of production and a more sustainable consumption. Implementing the CE in the leisure-related economy is also contributing to more sustainable tourism since it is building on a closed-loop concept so the local jobs and products are being promoted. CE is linked with sustainability and aims at protecting the nature and also the culture. So, the implementation of CE in the leisure-related economy and the cottage building indicates contribution to achieving target 8.4. and 8.9.

Oppdal is currently working a lot with sustainability and have many projects to create a more sustainable leisure-related economy and this including sustainable tourism. There are many local producers of cottages creating jobs in the region and there has been an increased focus on local production. The local culture is also one of the main attractions at Oppdal, and it is therefore projects on protecting this. Some of the relevant indicators for examining the CE in the leisure-related economy contribution to the SDG achievements are presented below.

- *8.4.1. The material footprint*
- *8.4.2. With regards to the material consumption in the region, which would contribute to the measuring of the domestic material consumption.*
- *8.9.2. That is number of jobs in tourism industries as a portion of total jobs and growth rate of jobs and by sex.*

The CE model in the leisure-related economy would try to make the materials stay in the system for a longer time, and the effect of this could be measured by indicator 8.4.1 and 8.4.2. The CE model are focused on local production and as the model is aimed at a leisure-related economy, many of the jobs that are in the region are within tourism. Therefore, will indicator 8.9.2 be interesting to measure the value creating in the region.

6.4.2. SDG 9 - Industry, Innovation and Infrastructure

To continue the sustainable development in the leisure-related economy there has been a strategic investment in research, innovation and infrastructure. The most relevant targets for the leisure-economy are found to be target 9.1 and 9.2.

9.1. Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all (UN, 2015).

9.5. Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending (UN, 2015).

The CE model for the leisure-related economy is building on a sustainable infrastructure. The infrastructure is important for creating good and environmentally friendly mobility options. The implementation of CE in the leisure-related economy is also building on innovation and sustainability research for a sustainable development and also for coming up with the technology to make it feasible. CE in the leisure-related economy could contribute to the achievement of target 9.1 and 9.5.

Oppdal has a developed infrastructure, but it can be even further improved with public transport options. The infrastructure at Oppdal are contributing to achieving target 9.1. Oppdal have several ongoing projects that are encouraging innovation and sustainability, they have projects with researchers and encourage to find sustainable solutions for the future to contribute to the achievement at target 9.5. To measure the impact of CE on SDG 9 indicator 9.5.1. could be used. The indicator is presented below. The indicator would present the focus on finding new and innovative sustainable solutions in the leisure-related economy.

- *9.5.1. Research and development expenditure as a proportion of GDP*

6.4.3. SDG 11 - Sustainable cities and communities

Oppdal is a mountain city in rural areas, and the most relevant targets for SDG11 is 11.4. and 11.A.

11.4. Strengthen efforts to protect and safeguard the world's cultural and natural heritage (UN, 2015).

11.A. Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning (UN, 2015).

The focus on sustainability in the CE-model is to protect the natural and cultural heritage. In the leisure-related economy the nature and the culture are one of the reasons people want to visit, and it is therefore an alternative incentive to protect in addition the protection to contribute to the sustainable development. The CE can support positive links between the urban, peri-urban and rural areas by the planning, this goes hand in hand with the importance of a good infrastructure as mention above and is why CE in the leisure-related economy can contribute to the achievement of target 11.4 and 11.A.

The focus on sustainability is to protect the natural heritage of Oppdal, and the motivation for developing new and innovative sustainable solutions for the cottage building is to protect the natural heritage. Developing the regional and national planning would support their leisure-related economy in an economic, social and environmental perspective since it would make it easier for tourist to visit Oppdal. Preservation of the nature and the culture is important for the leisure-related economy and therefor may indicator 11.4.1 be relevant to measure the contribution to achieve SDG 11.

- *11.4.1. Total expenditure (public and private) per capita spent on the preservation, protection and conservation of all cultural and natural heritage, by type of heritage (cultural, natural, mixed and World Heritage Centre designation), level of government (national, regional and local/municipal), type of expenditure (operating expenditure/investment) and type of private funding (donations in kind, private non-profit sector and sponsorship).*

6.4.4. SDG 12 - Responsible consumption and production

SDG 12 is most commonly linked SDG to the concept of CE because it has a connection with the core aspect of CE. The most relevant targets from this SDG is:

12.2. By 2030, achieve the sustainable management and efficient use of natural resources (UN, 2015).

12.5. By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse (UN, 2015).

12.6. Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle (UN, 2015).

12.8. By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature (UN, 2015).

12.B. Develop and implement tools to monitor sustainable development impacts for sustainable tourism that creates jobs and promotes local culture and products (UN, 2015).

CE is directly linked to responsible consumption and production. To achieve success with implementation of the CE-model in the leisure-related economy it is important that the businesses are to contribute. The businesses and industries are wanting to be a part of the circular economy and they see the incentives by being in an industrial symbiosis. Making the people aware of the possibilities and the importance of sustainable development is key for creating a marked for CE. The above mention targets are all directly linked to the contribution CE has in the leisure-related economy to achieve a sustainable development.

The targets above can be important targets for Oppdal as a leisure-related economy and the cottage building to look for continuing the sustainable projects that they already have started. For example, to encourage companies to adapt to sustainable practices and to integrate sustainable information into their reporting cycle are vital to implement a circular business model in the leisure-related economy and into the building of cottages. Also, to inform people and create awareness for sustainable development and lifestyles in harmony with nature is important to create a market for a more sustainable leisure-related economy and sustainable cottages and also circular leisure-related economy and circular cottages. There are a number of indicators from SDG 12 that can be relevant to measure the impact CE in the leisure-related economy and especially in the cottage building sector. The most relevant indicators are presented below:

- *12.2.1. Material footprint, material footprint per capita, and material footprint per GDP*
- *12.2.2. Domestic material consumption, domestic material consumption per capita, and domestic material consumption per GDP*

- *12.5.1. National recycling rate, tons of material recycled*
- *12.6.1. Number of companies publishing sustainability reports*
- *12.8.1. Extent to which (i) global citizenship education and (ii) education for sustainable development (including climate change education) are mainstreamed in (a) national education policies; (b) curricula; (c) teacher education; and (d) student assessment*
- *12.B.1. Number of sustainable tourism strategies or policies and implemented action plans with agreed monitoring and evaluation tools*

6.4.5. SDG 13 – Climate Action

CE is a way of managing our society and will act as a measure for climate change itself. The Norwegian circular thinking and strategies towards CE is at the beginning. The most relevant targets for SDG 13 are target 13.2. and 13.3.

13.2. Integrate climate change measures into national policies, strategies and planning (UN, 2015).

13.3. Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning (UN, 2015).

The CE in the leisure-related economy are working to protect the environment and the nature that the tourist is spending money to visit. The cottage owners are the happiest with the nature at Oppdal and that is motivation for the region to protect their sales pitch by implementing climate change measures in their policies, strategies and planning. As already stated, there need to be a market for CE and sustainable solutions, and for the market to grow education and awareness is important. Therefore, the above mention targets are also to be used as targets on a regional level as targets for sustainability in the leisure-related economy.

6.4.6. SDG 15 – Life on land

CE is a way of providing sustainable solutions for the life on land. The most relevant targets are presented below:

15.4. By 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development (UN, 2015).

15.5. Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species (UN, 2015).

15.9. By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts (UN, 2015).

All these targets are directly linked to the sustainable development of the leisure-related economy. The regulation of new land plots for cottages and the pressure of the nature when it is used by an increased population. The biodiversity loss is a threat for the leisure-related economy and must be considered when regulating the areas. The CE model for the leisure-related economy and for the cottage building may contribute to reaching these targets. There are several indicators that can be used to measure the sustainability on this goal. The most relevant target is mention below.

- *15.4.1. Coverage by protected areas of important sites for mountain biodiversity*

6.5. The Research Questions

The literature on CE is still relatively young. In this thesis, the potentials of CE in the leisure-related economy have been highlighted by making a CE model for the leisure-related economy and investigated a case study. In the following sub-chapter, the study the initial research questions are addressed.

6.5.1. How sustainable is the leisure-related economy in Norway?

Sustainability is a widely used concept and the leisure-related economy is a complex system. Actors in the leisure-related economy are working with sustainable development. There are several ongoing projects that aims at contributing with new and more sustainable solutions for the leisure-related economy. The nature is the sales pitch of Oppdal and to create value in their leisure-related economy they also need to protect the nature. With regards to the economic sustainability, Oppdal have local production, the nature and local labour power that contribute to value creation in the region. There are however some national and international companies that are working on Oppdal, and labour power from outside the region contributing to a slower value creation in Oppdal. With regards to environmental sustainability, Oppdal are working on several project to decrease the environmental impact. There are projects on how to make the cottages more sustainable, and how to make the mobility more sustainable. The alternative cost of the land used for cottages are a discussion with regards to the environmental cost of using this land for cottages. The analysis showed that Oppdal has both economic and ecological opportunities and threats and there are potential to become more sustainable.

6.5.2. How can the leisure-related economy become more sustainable?

As nature is a sales object in the leisure-related economy the economic and the environmental aspects are following each other. Creating a bigger market for renting out the cottages so the cottages have more days of use would increase the money spent in the region and therefor contribute to the leisure-related economy without using more of the land. There may however be more use of the nature, so the protection of the nature is important. The regulation of the land and the nature is an important tool to not overuse the nature and increase the threat of biodiversity loss. This is a paradox, the leisure-related economy wants to increase the value creation by such as building new cottages, and the more cottages there is the bigger threat is this to the biodiversity loss due to the invasion in the nature, and decreasing land value. The targets in the chosen SDGs are targets that can help guide the leisure-related economy in the sustainable direction. The use of indicators could also be helpful to evaluate the impact of the work done with sustainability in the region.

An option to become more sustainable is to improve the mobility in the leisure-related economy. This is showed in the case study, where Oppdal have the option to come to Oppdal with a train, but the public transport options from the train station to the cottages are not well developed. There are potential in finding new and more sustainable options to travel within the region, such as renting electrical bikes or more busses so there will be less cars used.

The circular economy models are a possibility to contribute to a more sustainable leisure-related economy. The model and the analysis argued that there are greater opportunities for the leisure-related economy to become more sustainable by implementing a circular

business model. The economical perspective of the circular business model implementation is with regards to a more closed system, and therefore it is more depended on local labour force. The value creation in the region may therefore increase. The implementation of circular economy in the leisure-related economy would contribute to the reuse of the materials, and increased sharing. The sharing of facilities can be in different ways, some cottages can be built with shared storage room or a shared living room. The cottages are also be shared as a whole or rented to prevent more land being used for cottage building. The reuse of materials is strongly linked with a sustainable design. Sustainable design will prevent unnecessary use of materials, evaluate the environmental footprint of the materials and design for a long lifetime in the system.

Knowledge and competence of becoming more sustainable is already there, more awareness the development in the leisure-related economy may be important to give the companies incentives to contribute to the CE. The cottage owners and tourist are the market and they need to be open for the sharing economy and the circularity of materials. Working with changing the people attitude with regards to reused products and materials may create a bigger market for the circular business model and contribute to the leisure-related economy to become more sustainable.

6.5.3. How can principles from circular economy affect the sustainability in the leisure-related economy?

Principles from the circular economy affect the sustainability in the leisure-related economy by contributing to an increased sharing between the people and the companies. The suggestion of the bank of materials and the matchmaking of companies are building a lot on trust between the companies for it to work. The bank of materials and the matchmaking could be a physical place as well as a digital platform. A visualisation of the industrial symbiosis may contribute to a trust between the companies and to create awareness amongst others. The principles of staying in the highest levels of the waste pyramid as long as possible are principles that increased potential if it is facilitated for reuse, which can increase the sustainability in the leisure-related economy.

7. Discussion

This section will present a discussion of the results and analysis. First will there be a discussion of the limitations of the study, before an evaluation and discussion of the circular economy model is presented. Then there will be an evaluation and discussion of the case study. In this section the fit between the case study and the model will also be discussed. Thereafter there will be a section where the results in this thesis will be compared with other studies, and in the end, there will be reflections on the reliability, the validity and the generalisability of the study.

7.1. Limitations of the study

The limitations of this study concern elements of the chosen research methods, the data acquisition, the developed model, the case studied and the different elements that were examined and analysed. The author made the choice to focus on the environmental and the economic aspects of sustainability and do not directly focus on the social aspect. This is also a limitation of the study since the sustainability concept included all three aspects, but due to the frame of the study the economic and the environmental aspects was evaluated to be more important for this study, and the social aspect may be included indirectly. Due to the scope of the study the technicalities of the cottages are also not included in this study.

Case studies are a challenging research method, due to the lack of structure in the data acquisition (Adams et al., 2014). The case study had a qualitative approach and this makes it more difficult to be objective when collecting data then when the data is quantitative (Johannessen et al., 2010). Due to the timeframe of the study and the current situation the data collection was adopted to that. One of the limitations with this study is that the author was not able to get in touch with as many people and companies as desired or to go visit Oppdal to gain insight in the dynamics in the community. This may affect the case study's complexity. When conducting the interview with Lundhytta, the interview was conducted as a telephone interview. The information that was not conducted was not personal or sensitive, and therefore the choice of interview format did not affect the study significantly, but it would have given the author a better insight if it was possible to go to the company and look at the facilities. On the other hand, the telephone interview was less time consuming for both parts. A visit in Oppdal would also had strengthen the insight into the possibilities for circular economy in the area.

The author was also supposed to observe another workshop to gain more insight in different perspectives and ideas on the work with sustainability in the leisure-related economy, due to the situation the workshop got cancelled, and the lack of this information is a limitation of insight in the local community's thoughts and ideas. Observing a workshop also comes with limitations and strengths. As an observer the people in the workshop can work freely and interact with each other, there is a lot of information from several actors and there might be value information that disappears in all the other information.

The model made for the CE in the leisure related economy and the model made for the cottages are simplified. The real-life leisure-related economy is complex and for making the model usable there had to be some simplifications. There are limitations attached to this, since some aspects disappear in the simplicity. The models are made to show the

environmental and economic aspects of implementing a CBM in the leisure-related economy and therefor such as "local businesses" are just one box and now divided into all the different businesses or industries. Dividing the "local businesses" into different industries would have been useful to investigate the how the different industries are affected by each other in the leisure-related economy, but due to the timeframe this was not included in the study.

The case study is based on qualitative data and therefor the analysis of the data is also done on a qualitative approach. The data collection was made independently of the analysis done, but it was already decided before collecting the data that the data collected was supposed to be put into a system. This may have interfered with the way the data was collected and how the data was intercepted, but having three different ways of analysis the data may have contributed to a broader analysis and therefore limiting this. The system analysis was based on the thoughts of having more quantitative data to easier identify the environmental impact, but the quantitative data on this was hard to collect. The qualitative analysis of the system analyses the potential of implementing a circular business model and the quantitative data would then only have been an assessment to this and would have been useful for optimising the system.

7.2. Evaluation of the circular economy models

The potential of the circular economy models for the leisure-related economy and for the cottages are depended on the acceptance of the society and of the companies. The models highlight what is needed to implement a circular economy in the leisure-related economy. Nevertheless, it does not take into account the feasibility of doing it. There need to be a market for circular economy. The society need to accept the use of reused products, and make a demand for it. The companies need an incentive to implement circularity in their business models, the companies are working for profit and are dependent on a market accepting the products. The economic market today is based on consumption, so for a circular economy there need to be a decoupling between resources and profit, as in a green growth economy (Sandberg et al., 2019). Twisting the marked to change the value creation is needed. The model also highlights the competence, and that is crucial to finding the best ways to prevent use of materials, reuse, recycle, and recover energy of the resources. Preventing the unnecessary use of resources, increase reuse and recycling to maintain a high level in the waste pyramid is substantial for a sustainable development and also mentioned by Haines-Gadd and Charnley (2019) as methods and strategies for value creation in a CE.

Competence and trust have been chosen to be implemented in the model and is supported by the management principles by Ludwig et al. (1993) whereas trust to scientist was one of the five principles. Also, the is important for the awareness about the reorienting, expectations and motivations when implementing a CBM (Jørgensen and Pedersen, 2015). These flows are hard to measure, but truly important especially in a qualitative analysis. The increased sharing of resources is depended on a level of trust been people and companies, the competence is also crucial for the sustainable design and evaluation of resources.

The model includes the importance of the infrastructure for a well-functioning circular and sustainable leisure-related economy. The infrastructure in the leisure-related communities

is important for the cottage owners to wanting to visit the destination, but the infrastructure is not built for everyone to be there at the same time. If everyone went to the cottages at the same time, the population in the leisure-related communities could double, thus the infrastructure is not built for this. This was seen with regards to health care in 2020 when there for a period was forbidden to go to the cottages due to increased risk of too high pressure in the health care systems. Including the focus on a sustainable infrastructure is therefor on of the strengths with the model, but also one can think that is would neither be environmentally or economic sustainable to build a infrastructure with capacity for everyone being the region at the same time, when this probably is rarely the case.

The model is a simplification, but the model can still be used as guidance and to highlight the importance of circularity and sustainability. To face the future challenges of the leisure-related economy, there needs to be an increased focus on sustainability. The models provide value for the development of the leisure-related economy by providing the industry, the business developers, the municipality, the policymakers and the stakeholders insight towards a sustainable development using a circular business model in the leisure-related economy.

7.3. Evaluation of the case study

The case study fitted quite well into the models, but the models are made slightly more general. The case study and the model were developed in the same process, and therefor to evaluate the models a bit further a comparison with another destination would be useful to gain more insight. The actors contacted in this thesis was already working comprehensive with sustainability, and it would have been interesting to also include actors that did not have the same focus on sustainability. The case study is also simplified to have focus on the main point, the circular business models and the sustainable development.

The leisure-related economy at Oppdal is not a closed loop, and it is not a likely possibility for the future either, it would not be feasible. The region is regulating a lot of land plot for cottages, and it is a market for bigger national companies to also build cottages. The region is depending on importing goods and services for other regions and from abroad, and must rather work to minimise the input of new resources into the system. Using the circularity is however coherent with the urban circular metabolism Eaton et al. (2007). The model and the analysis argue that the public transport options should be improved to make it easier to go to the cottages using public transport instead of car. The cottage owners could still choose to go to their cottages with their car regardless of the public transport option, but the model and the analysis at least highlights the purpose of increasing the public transport options.

Lundhytta already work a lot with sustainability and research on sustainable solutions. The materials in a cottage have usually a long lifetime, and a cottage is not usually dissembled often, therefor the struggle of having enough resources into the material bank need to be considered. There are also regulations on the quality of the materials used in TEK17 (Direktoratet For Byggkvalitet, 2017), and this is not included into the considerations in the model, but should to be considered in the case study. The potential of reprocessing

leftover components has a greater potential since the component is not even used and quality of the material should be usable.

In summary, if the society is open for a circular leisure-related economy this would be a contribution to a sustainable development in the leisure-related economy. The CBM may contributing to lowering the environmental impact, especially of the cottage development. However, the problem with the circular business model is to find a way of making it cost efficient and creating a market for it. The value creation triangle (Haines-Gadd and Charnley, 2019) and the implementation strategies by Jørgensen and Pedersen (2015) are helpful tools to achieve success with the CBM. Sustainable and circular design could also start today to contribute to a successfully implementation in the future. Thus, the possibility of the implementation of the model depends on the receiving society and the implementing company.

7.4. Discussions of the analysis and comparison with other studies

On the topic of circular economy in the leisure-related economy and the cottage building there is not many studies done. The research done on the leisure-related economy is focused on the economic effect and not directly included the environmental effect. Sustainable development should consider the environmental, the economic and the social aspect, the TBL, thus the focus on only the economic effects and the ripple effects state little about the environmental effect and therefore might make it hard to compare the environmental effects in the leisure-related economy. There are however some studies that investigate the CE potential of tourism. The limited actors examined in this case study makes the evaluation and the generalisability difficult. However, there are studies done on the circularity in buildings and when considering the high standards of cottages, the last years, it would make sense to compare a study done on houses with the cottages. The different assumptions made in the different studies, and the different regulations are important to keep in mind when comparing the studies. The buildings in different countries and different areas have different needs with regards to the climate, the natural forces and the different seasons, so this should also be considered when comparing with other studies.

As mention above, one can argue that due to the high standards of the cottage the studies done on houses and building can be used for comparison. This study is more focus on the knowledge and the competence between the companies in the leisure-related economy than the previous studies, which was one of the suggestions that Rodríguez et al. (2020) had for the tourist sector to become more circular. The focus in the CE is usually based on materials, energy and water.

This study found that the implementation of a circular economy model for the leisure-related economy may incorporate more local labour power and thus increase the value creation in the region further, which is supported by the findings done by Arnesen and Teigen (2019). The need for a change in the leisure-related economy is supported by Manniche et al. (2017). This case study also shows that there is an increase in the development of cottages and there is a need for new and innovative thinking for a sustainable leisure-related economy. The development of the cottages is supported by Vittersø (2007).

Cottage owners wanting to preserve the rural community and nature, whereas the locals are more open for new development, using the investments in cottages as a development strategy and increase the value creation in the community was found by Farstad et al. (2008) and Farstad and Rye (2013), even though Farstad and Rye (2013) found that there was less gap between the interest of the cottage owners and the local community than previous research suggested. This is in still in contradiction with the findings in this study. This study found that the local community is working a lot to preserve the nature and working to find new options to increase the value creation at the same time as the nature and rural community is preserved. However, this case study is conducted with contribution from companies and dialogue with local that are working with sustainability and therefore find the prevention of the nature and the rural community more important.

There was indicated in Moe (2019) and Arnesen and Teigen (2019) that bigger land plots for the cottages could increase the value creation in the region due to the option of building more on the cottage or building annexes. This study agrees in an economic perspective, but also considers the threat of biodiversity loss when using more land. This study suggests building more shared cottages on smaller areas to have more shared utilities and thus less land needs to be regulated to cottage areas. This is supported by Velvin et al. (2013), Skjeggedal and Overvåg (2014) and Ellingsen and Arnesen (2018).

This study tries to capture the environmental impacts from the leisure-related economy, as does Thorvaldsen (2019) and Nordby (2011). They found potentials for improve the environmental impact and reduce biodiversity losses by changing transport options, building more efficient and material substitutions and reuse. However, these studies difference from this study since they are based on LCAs and do not take the economic perspective into account. The same goes for the potential for reduced environmental impact found in Hossain and Ng (2019), Minunno et al. (2020) and Nußholz et al. (2019) which also is conducted using LCA as method.

7.5. Reliability, Validity and Generalisability

In this section reflection on the reliability, validity and the generalisability are conducted.

7.5.1. Reliability

The study has tried to be as transparent as possible. The steps have been explained as thoroughly as possible. Scientific and peer-reviewed literature and self-conducted interview, observation of workshops and dialogue with actors working with the leisure-related economy have been used in this study and interpreted after best of knowledge. Because of the nature of the multidisciplinary approach and because of the lack of essential knowledge in many fields can lead to inaccuracies in how the data was comprehended. To minimize the errors, the interview guide was pre-tested, revised and then pre-tested again. The study is largely based on quantitative data that have been interpreted by the author. The actors that was contributing to the study was all working with sustainability and had several ongoing projects on this, so therefore this might affect the reliability. The close collaboration with Nasjonalparken Næringshage can also be considered as high value for the reliability of the model's relevance for the Norwegian leisure-related economy.

7.5.2. Validity

The theory collected, the content and where it was found is tried to be as coherent with the research questions as possible. In order to validate the research, the relevant theory for the case study is used. The semi-structured interview was used a guide to direct the dialogue in the interview in the right direction for the aim of the research. The topic of the thesis was also known in the interview and this might have interfered with the way the interviewee chose to answer the questions asked and what information that was highlighted. The interviewer had not the option to go facilitate in real life, and therefor just had to work with the information gotten through the interview, observation of workshop, dialogue and literature search. Due to the use of several methods to analyse, and the use of relevant theory, the research is considered to be relatively valid.

With regards to the internal validity the companies and actors chosen to work with was companies that already was working with sustainability. The leisure-related economy also has several aspects that could have been research closer such as cottages are done in this study. For external validity the model and the analysis are based on relevant theory. The theoretical resources tried to give an overview of several possible aspects of the study, and based on the theoretical resources the model tried to come up with the best possible framework for the further work. Circular economy is a developing field, but based on the current knowledge, the study tried to make the best evaluation and work on answering the research question. For the construction validity, there are used several information sources for both the leisure-related economy and Lundhytta, but most is internal information and one might argue that this could be seen as the same source. To have a great construction validity it would be better to use more sources and to stay in Oppdal to observe the patterns of collaborations, the patterns of cottage owners and the patterns of tourists. The land planners on the municipality would also been a source to contribute to the construction validity. The model is not tried and therefor the reasonability of the conclusion is hard to evaluate. However, based on the other comparison with the other studies the conclusion validity is relatively high.

7.5.3. Generalisability

This study investigates one case study, and due to the lack of case studies to compare with, the rigidity of the theory and the generalisability of the study is hard to evaluate. Nevertheless, the study is done as transparent as possible so other researchers can see the degree of transferability. The case study is compared to the models made, and the models made are based on the theory, but there is no guarantee that the findings can be extrapolated into generalised insight.

The case study also contains limitations as it is only based on one leisure-related economy and one company, and there could be big differences between the different leisure-related economies and the different companies. It would have been useful to examine several case studies on mountain leisure-related economies to have a "benchmark". It would also been useful to look at other industries than the building of cottages to have a broader system. Due to the timeframe it was only possible to look at a system of a certain size and only analyse certain aspects of the system. To be able to generalise the study with good reliability and validity it would have to be done several studies.

8. Conclusion

The purpose of this thesis has been to investigate the possibility for sustainability in the leisure-related economy with an ecological and economic perspective. The study examines the possibility to use sustainable and circular business models to become more sustainable. The study developed a circular economy model and examined Oppdal as a case study and looked at the leisure-related economy and a cottage producer. The model is a simplification which may affect the results. The study indicated a potential of reduced environmental impact when implementing circular principles in the business models for the leisure-related economy.

Actors in the leisure-related economy are already working with sustainable development. There are several ongoing projects that aims at contributing with new and more sustainable solutions for the leisure-related economy. Implementation of the circular economy in the leisure-related economy is complex. Implementation on a business/consumer level, on a community level and in policies may contribute to environmental and economic benefits from CE. The study also suggested to increase the sharing in the leisure-related economy, thus contribute to a more sustainable leisure-related economy. The study suggested to implement a bank of materials, a place to reuse, and matchmaking companies needs as methods for increasing the circularity in the leisure-related economy. Increased sharing may slow the need for more land plots and the use of materials. The economy however should work to decouple resources and value creation for CE to also increase the economic sustainability in the leisure-related economy. The study found that some SDG targets and indicators can be used as guidance for the CE in the leisure-related economy. Knowledge and competence of becoming more sustainable is already there, but more knowledge, competence and awareness about sustainability and circular economy in the leisure-related economy may be important to give the companies and the market incentives to contribute to the CE.

In summary, the model for circular economy in the leisure-related economy are simplified, but the model has the potential of being used to guide towards a circular leisure-related economy. The model indicates environmental and economic benefits from implementing a circular economy model in the leisure-related economy, but that is depended on awareness in the market and incentives for the businesses and the community. However, the study provide research on the process of implementing sustainability and circularity in the business models in the leisure-related economy which is beneficial for future research in the field.

8.1. Recommendations

Based on the results of the study, the proposed new model of the circular economy for the leisure-related economy may contribute to the leisure-related economy becoming more sustainable. The leisure-related economy could implement the bank of materials and matchmaking between companies to increase the reuse. They could use the chosen SDG targets and the following indicators to evaluate the contribution to sustainable development. They should research on sustainable design to make increase the possibilities to reuse materials in the future, and to choose materials with minimised environmental impact. The successfulness of the implementation of the circular business models may increase with information, awareness of the current development and building trust between the companies. The building trust between the companies may be achieved by using local contracts, having workshops on the chosen platform for the bank of materials

and the matchmaking to give the companies an ownership to the project and the contribution.

8.2. Further Research

This study had a focus on the environmental and the economic aspect of the sustainability, so future research could include the social aspect of sustainability. The model could also include other aspects and include several micro systems, and this can be done in future research. The alternative cost of the land use for the cottages could also be interesting to further investigate, this could be done, by e.g. making a model for the agricultural sector and other sectors to investigate the impact of the lost land plot. Further research could also investigate several mountain leisure-related economies so it would be easier to evaluate the results. Further investigation of the motivation for implementing circular principles in the leisure-related economy in the market, both for the businesses and for the tourist/cottage owners.

Further studies could gather more quantitative data on the flows of materials and energy in the area, and conduct an MFA and/or LCA on different segments of the leisure-related economy. Future research could also work on an optimisation model based on quantitative data to optimise the material use, energy use and land use.

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A. Appendix

A.1. The interview guide (Norwegian)

Intervjuguide masteroppgave om sirkulærøkonomi på Oppdal

Forretningsmodellen:

- Hvilken verdi leverer dere til kunden?
- Hva er bedriftens nettverk?
- Hva er dine hovedleverandører?
- Hva er deres viktigste kostnader/inntekter?
- Hvordan jobber dere med bærekraft?

Ressurser:

- Har dere egen produksjon eller er produksjonen eksternt?
- Hvilke energikilder bruker din bedrift?
- Hva er betydningen av energibruk i din bedrift?
- Hvilke materialer bruker din bedrift?
- Hvilke typer restmaterialer har din bedrift?
- Hvor mye restmaterialer har din bedrift?

Motivasjon til bærekraft:

- Er dere interessert i å finne lokale samarbeidspartnere?
- Tror dere bærekraft og grønn forretningsutvikling vil ha en økende innvirkning på bedriften i fremtiden?
- Er dere villig til å investere i grønn forretningsutvikling og bærekraft?

A.2. The interview guide (English)

Interview guide for the master's thesis. Topic: Circular Economy at Oppdal.

Business model:

- What value do you deliver to the customer?
- What is the network of the company?
- What are your main suppliers?
- What is your main cost/income?
- How do you work with sustainability?

Resources:

- Do you have your own production or is the production external?
- What energy sources does your company use?
- What is the significance of energy use in your company?
- Which materials do your company use?
- Which types of residual materials do your company have?
- How much residual materials do your company have?

Motivation for sustainability:

- Are you interested in finding a local business partner?
- Do you think sustainability and green business development will have an increased impact on the company in the future?
- Are you willing to invest in green business development and sustainability?

A.3. Selected Sustainable Development Goals

The goals, targets was developed in 2015, and the indicators in 2017 (UN, 2015, UN, 2017). In Table 12 to Table 17 are the SDG targets and indicators that is assumed to be most relevant for this study.

Table 12: Sustainable Development Goals 8, targets and indicators (UN, 2015, UN, 2017).

Goal	Target		Indicator	
8 - Decent work and economic growth	8.4.	Improve progressively, through 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation, in accordance with the 10-year framework of programmes on sustainable consumption and production, with developed countries taking the lead	8.4.1.	Material footprint, material footprint per capita, and material footprint per GDP
			8.4.2.	Domestic material consumption, domestic material consumption per capita, and domestic material consumption per GDP
	8.9.	By 2030, devise and implement policies to promote sustainable tourism that creates jobs and promotes local culture and products	8.9.2.	Number of jobs in tourism industries as a proportion of total jobs and growth rate of jobs, by sex

Table 13: Sustainable Development Goals 9, targets and indicators (UN, 2015, UN, 2017).

Goal	Target		Indicator	
9 - Industry, Innovation and Infrastructure	9.1.	Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all		
	9.5.	Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending	9.5.1.	Research and development expenditure as a proportion of GDP

Table 14: Sustainable Development Goals 11, targets and indicators (UN, 2015, UN, 2017).

Goal	Target		Indicator	
11 - Sustainable cities and communities	11.4.	Strengthen efforts to protect and safeguard the world's cultural and natural heritage	11.4.1.	Total expenditure (public and private) per capita spent on the preservation, protection and conservation of all cultural and natural heritage, by type of heritage (cultural, natural, mixed and World Heritage Centre designation), level of government (national, regional and local/municipal), type of expenditure (operating expenditure/investment) and type of private funding (donations in kind, private non-profit sector and sponsorship)
	11.A.	Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning		

Table 15: Sustainable Development Goals 12, targets and indicators (UN, 2015, UN, 2017).

Goal	Target		Indicator	
12 - Responsible consumption and production	12.2.	By 2030, achieve the sustainable management and efficient use of natural resources	12.2.1.	Material footprint, material footprint per capita, and material footprint per GDP
			12.2.2.	Domestic material consumption, domestic material consumption per capita, and domestic material consumption per GDP
	12.5.	By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse	12.5.1.	National recycling rate, tons of material recycled
	12.6.	Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle	12.6.1.	Number of companies publishing sustainability reports
	12.8.	By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature	12.8.1.	Extent to which (i) global citizenship education and (ii) education for sustainable development (including climate change education) are mainstreamed in (a) national education policies; (b) curricula; (c) teacher education; and (d) student assessment
	12.B.	Develop and implement tools to monitor sustainable development impacts for sustainable tourism that creates jobs and promotes local culture and products	12.B.1.	Number of sustainable tourism strategies or policies and implemented action plans with agreed monitoring and evaluation tools

Table 16: Sustainable Development Goals 13, targets and indicators (UN, 2015, UN, 2017).

Goal	Target	Indicator
13 - Climate Action	13.2. Integrate climate change measures into national policies, strategies and planning	
	13.3. Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning	

Table 17: Sustainable Development Goals 15, targets and indicators (UN, 2015, UN, 2017).

Goal	Target	Indicator
		15.4.1. Coverage by protected areas of important sites for mountain biodiversity
15 - Life on land	15.5. Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species	
	15.9. By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts	

A.5. SDG Interactions

The key interaction of SDG 12 is presented below, and the data is retrieved from UN (2015).

SDG 12 + SDG 1

Targets	Interactions identified	Score
12.1 → 1.5	Implementing programmes for sustainable consumption and production may contribute to more equality in the food supply, but this can also increase the prices in the production.	-1

SDG 12 + SDG 2

Targets	Interactions identified	Score
12.4 → 2.1,2.3	Reduction of released chemicals and minimised adverse impact on human health and the environment may contribute to secure land used for agriculture.	+ 1
12.4 ← 2.1	If the use of agrochemicals is used, it interferes with the reduction of chemicals. Depends on the technology.	-2

SDG 12 + 3

Targets	Interactions identified	Score
12.8 ← 3.3	Lifestyles in harmony with nature and may include turning away from modern vaccines, thus affects the end of epidemics.	-1
12.4 → 3.9	Reduction of released chemicals and minimised adverse impact on human health and the environment may contribute to the reduction of deaths and illnesses from hazardous chemicals and air, water and soil pollution.	+3
12.7 → 3.8	Promote public procurement practices that are sustainable may contribute to universal health coverage, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all.	+1

SDG 12 + 4

Targets	Interactions identified	Score
12.8 → 4.4/ 4.4 ← 12.8	Ensuring that people everywhere have the relevant information and awareness for sustainable development, may contribute to young and adults having the relevant skills for employment, decent jobs and entrepreneurship. The other way around has more positive interaction, thus relevant skills can contribute to information and awareness.	0/+1

SDG 12 + SDG 5

Targets	Interactions identified	Score
12.7 → 5.4	Sustainable public procurements in accordance with national policies and priorities may contribute to public services, infrastructure and social protection.	+1

SDG 12 + 6

Targets	Interactions identified	Score
12.2. → 6.3, 6.6.	Sustainable management and efficient use of natural resources contributes to increasing recycling of water, improving the water quality, and thus protect and restore water-related ecosystems.	+1
12.2 → 6.4	Sustainable management and efficient use of natural resources contributes to increased water-use efficiency.	+2

SDG 12 + 7

Targets	Interactions identified	Score
12.2 → 7.2,7.3	Sustainable management and efficient use of natural resources contributes increase the sharing of renewable energy and improves the efficiency.	+1

SDG 12 + 8

Targets	Interactions identified	Score
12.5 ← 8.2	Economic growth through diversification, technological upgrading and innovation, including through a focus on high-value added and labour-intensive sector may contribute to reduce waste through prevention, reduction, recycling and reuse.	+1
12.1, 12.8 → 8.4	Implementing programmes for sustainable consumption and production, and ensuring that people have information and are awareness may contribute to global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation.	+1

SDG 12 + 9

Targets	Interactions identified	Score
12.7 → 9.1	The public procurements are involved with the development of the infrastructure and may support a sustainable infrastructure for economic development and well-being.	+1
12.8 ← 9.5	Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries may contribute to the spread of information and awareness about sustainable development.	+1

SDG 12 + 10

Targets	Interactions identified	Score
12 → 10.1, 10.2, 10.3	There is not a direct link between goal 12 and goal 10, but the sustainable management, consumption and production may contribute to growth and the growth may contribute to reduced inequality.	0

SDG 12 + 11

Targets	Interactions identified	Score
12.2, 12.4, 12.5 → 11.6	Sustainable management, management of chemicals and waste reduction may reduce the adverse environmental impact of cities with a special attention to air quality and waste management.	+2

SDG 12 + 13

Targets	Interactions identified	Score
12.8 ← 13.3	Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning may contribute to the access of relevant information and increase the awareness of sustainable development.	+2

SDG 12+ 14

Targets	Interactions identified	Score
12.2, 12.5 → 14.3	Sustainable management of natural resources and waste reduction may have a link to minimizing the impacts of ocean acidification.	0

SDG 12 + 15

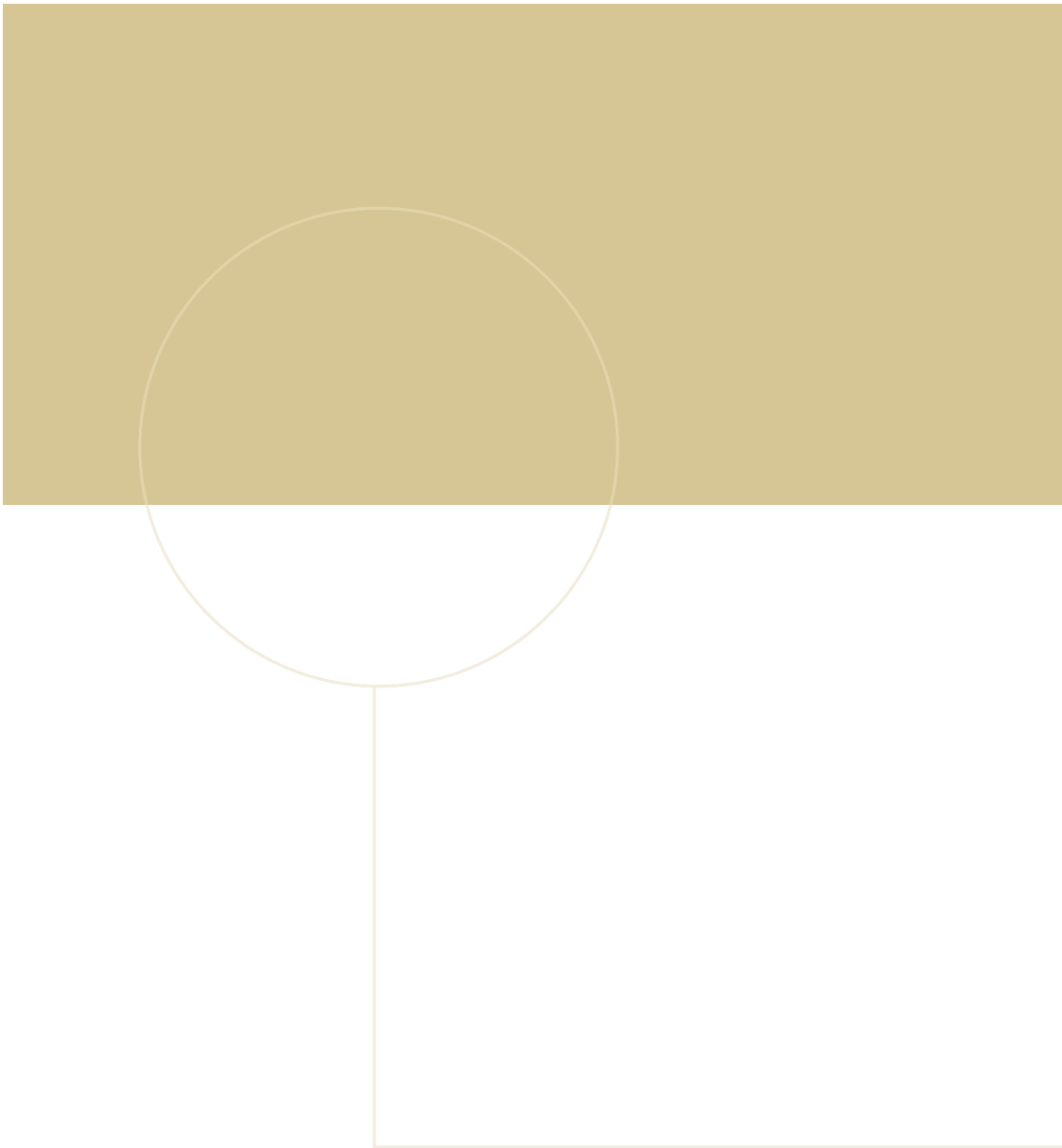
Targets	Interactions identified	Score
12.2, 12.4, 12.5 → 15.1, 15.4	Sustainable management of natural resources and waste management contributes to less use of natural resources, thus less invasion in the nature, thus contributing to conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystem and conservation of mountain ecosystems, including their biodiversity.	+2
12.8 → 15.5	Live inharmony with the nature is sufficient with prevent the degradation of natural habitats, but not enough action to reducing the degradation.	0

SDG 12 + 16

Targets	Interactions identified	Score
12 → 16	Sustainable consumption and production patterns help improve the economic growth, thus may help improve the inequality, but the connection to peaceful and inclusive societies are not strong enough.	0

SDG 12 + 17

Targets	Interactions identified	Score
12 ← 17	The implementation of goals, requires finance, technology, system change. The policies need to be coherent with the goals.	+1



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