



Norwegian University  
of Life Sciences

**Master's Thesis 2022 30 ECTS**

Faculty of Landscape and Society

# **Barriers and drivers to a circular economy for vegetables in the Norwegian food sector**

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International Environmental Studies

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May 2022

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## **Declaration**

I, Andrea Christine Kunz Skrede, declare that this thesis is a result of my research and findings. Sources of information other than my own have been cited and a reference list has been appended. This work has not previously been submitted to any other university for the award of any type of academic degree.

Date.....16/05/2022.....

Signature.....Andrea Christine Kunz Skrede.....

## **Acknowledgements**

My passion for food stems from the countless hours spent by my grandparent's kitchen table. My grandfather was a chef, and my grandmother was concerned with never letting any food go to waste. The knowledge and values they have transmitted to me constitute the basis for why I wanted to investigate this topic.

This thesis would not have come through without the strong support and invaluable contributions from a number of people. First of all, I would like to give my deepest thanks to my supervisor Arild Vatn for his feedback, advice and encouragement throughout the whole process. I would also like to thank all the respondents who have participated in this study, for sharing their time and perspectives with me.

Furthermore, I would like to express my sincerest gratitude to my family, friends and partner for their love and endless support. I am especially grateful to my mother who has contributed with her care, curiosity, critical reflection, and insightful feedback - not just in this thesis, but throughout my entire academic journey.

## **Abstract**

Food systems are pressing the environment in multiple ways, Moreover, some of these pressures are due to inefficient resource use. It is estimated that as much as one third of all food being produced globally is lost or wasted. One of the most wasted food categories globally is fresh fruit and vegetables. In order to avoid the crossing of planetary boundaries, scientific and political communities have signaled the urgent need to change current practices in the global food system. As a response to this, the concept of circular economy is increasingly being recognized as a possible approach to create more sustainable food systems. However, there is a need for more knowledge on barriers and drivers to a circular economy transition, in order to move from theory to practice. With the aim of contributing to such knowledge, this study investigates the barriers and drivers to a transition to a circular economy for vegetables in the Norwegian food system. Through a qualitative case study, perspectives from leaders in businesses working in the various components of the value chain for vegetables have been collected and analyzed. The study takes on a systems perspective and holds the ambition of gaining a greater understanding of how the barriers and drivers are relevant and manifested across the value chain, as well as how these factors are connected to other actors, institutions, and spheres in the greater system. The findings of this study indicate that central barriers are: hindering regulations; lack of political incentives and economic risk; the size and standardization of economic processes; consumer preferences; the conflict between vegetables and supporting resources; knowledge gaps and lack of awareness; lack of holistic thinking and collaboration; lack of willingness to change; and power structures in the value chain. Furthermore, the identified drivers are: increased knowledge and awareness; circular approaches are becoming profitable; political responsibility, incentives, and guidelines; collaboration and holistic thinking; new technologies; and strategic division of power. Thus, the drivers are both direct responses to the perceived barriers, or separate factors seen to enable circular initiatives. Moreover, this study finds that many of the identified factors affecting a transition to a circular economy for vegetables are interlinked, overlapping and dependent on each other. This should be taken into consideration when creating measures aimed at facilitating a transition to a circular economy for vegetables in the Norwegian food system.

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## 1.0 Introduction

One-third of all anthropogenic greenhouse gas emissions stem from the food system (Crippa et al., 2021). In addition, activities in the food system contribute to a number of other environmental pressures, such as water, land and air pollution, land-use change, and ultimately biodiversity loss. However, several of these environmental pressures could be avoided if food resources were used more effectively. The Food and Agriculture Organization of the United Nations estimates that as much as one-third of all food being produced globally is lost or wasted (FAO, 2013). In addition to adjusting agricultural practices and consumption patterns, it is essential to find strategies that allow us to move away from this inefficient resource use to ensure a development that can sustain the needs of both current and future generations.

In recent years, the concept of the circular economy (CE) has gained attention from scholars, policymakers, and the private sector as a possible approach to creating more sustainable food systems. CE refers to an economic system based on replacing the current linear take-make-dispose model with a higher circulation of materials and thus ultimately lower resource extraction and waste production. It is a systems approach aimed at accomplishing sustainable development through economic prosperity, environmental quality, and social equity (Kirchherr et al., 2018). Concerning food systems, the Platform for Accelerating Circular Economy has furthermore defined three objectives for a circular food economy: 1) food production is done in ways that regenerate nature, 2) food is not being lost or wasted, and 3) resources that are commonly wasted are used productively (PACE, 2021)

The potential of applying the concept of CE to food systems is increasingly being recognized in the political sphere, both internationally and nationally. For example, the EU strategy called 'Farm to Fork' put forward by the European Commission, specifically states that the Commission will take action to promote more circularity in the food system (European Commission, 2020). Also in Norway, the Circular Economy Strategy of the Norwegian government addresses the potential of applying circular approaches to the agri-food system (Klima- og miljødepartementet, 2021).

In 2020, more than 450 000 tonnes of food were lost or wasted in Norway. Although a large fraction of registered food wastage stems from private households, there are still high levels of food being wasted throughout the value chain before even reaching consumers. One of the

product groups being wasted the most in all components of the value chain is fresh fruit and vegetables (Regjeringen, 2021a). There is thus arguably a great potential in transitioning to a CE for vegetables in the Norwegian food system.

## **1.1 Problem statement and research questions**

This study aims to shed light on barriers and drivers to a transition to a CE for vegetables post-harvest in the Norwegian food system, in order to illuminate what measures might be needed to facilitate change. Barriers refer to those factors obstructing the transition, while drivers indicate those factors which are already or could enable and encourage it. In the Circular Economy Strategy of the Norwegian government, it is stated that there is a need for more information on the regulatory, economic, technical, structural, cultural, and knowledge-related barriers to the transition into a more circular economy (Klima- og miljødepartementet, 2021). Therefore, the aim of this thesis is to contribute to filling the knowledge gap on such barriers relating to vegetables and the food system, as well as factors that might drive the transition. Through a qualitative case study, this research focuses on the perspectives of leaders within businesses working in various components of the value chain for vegetables in the Norwegian food system. Gathering perspectives from actors who hold different positions in the same system allows for a systemic approach to barriers and drivers, through investigating interactions, power relations, as well as similarities and discrepancies in perspectives within the value chain.

The research questions this thesis aims to answer are the following:

***Q1:** What are the barriers to a transition to a circular economy for vegetables in the Norwegian food system, as understood by leaders within businesses in this system?*

***Q2:** What are the drivers to a transition to a circular economy for vegetables in the Norwegian food system, as understood by leaders within businesses in this system?*

This thesis is structured in the following way: In chapter 2, the background for this research is provided through a review of existing grey and peer-reviewed literature. Following this, chapter 3 will present the theoretical concepts and framework that will guide the analysis and discussion, whereas in chapter 4 the methods applied in this research will be explained. Next, an analysis of the collected data will be provided in chapter 5, followed by a discussion of the

implications of the findings in chapter 6. Finally, chapter 7 will provide the conclusion of the analyses and discussion, as well as some remarks on further research.

## **2.0 Background**

In this chapter, general insights on the research topic will be put forward. First, insights from the literature on the environmental challenges of the current food system will be provided. Next, the concept of CE and its application will be discussed. Following this, the current status and development in relation to circular approaches in the Norwegian food system with a closer consideration of vegetables will be described. The chapter will be concluded with a review of central barriers and drivers to CE identified in the literature.

### **2.1 The environmental pressures of the food system**

The global food system is pushing environmental limits in several ways. As much as one third of all global anthropogenic greenhouse gas (GHG) emissions stem from various stages of food systems (Crippa et al., 2021). Furthermore, the food system is a major driver of biodiversity loss, land-use change, pollution of both terrestrial and aquatic ecosystems, and depletion of freshwater resources. More alarmingly, with the expected changes in population and income levels, including continued change towards Western consumption patterns, the environmental effects of food systems could increase as much as 50%-90% between 2010 and 2050 in the absence of targeted mitigation measures (Springmann et al., 2018). The global food system has already contributed to the crossing of multiple ‘planetary boundaries’, which aim to define a safe operating space for humanity in order to continue to develop and thrive for generations to come (Rockström et al., 2009; Steffen et al., 2015; Springmann et al., 2018).

Quite a fraction of GHG emissions and environmental pressures stemming from the food system is due to inefficient resource use - food wastage occurs throughout all stages of supply chains. The Food and Agriculture Organization of the United Nations (FAO) estimates that one-third of all food produced in the world for human consumption is lost or wasted. The emissions stemming from food loss and waste annually represent about 8% of total anthropogenic GHG emissions. This means that if food loss and waste were a country, it would be the third-largest emitter in the world after China and the United States (FAO, 2013) These numbers point to missed opportunities for both the economy, food security and keeping the environment within viable limits.

## **2.2 Circular economy: an approach to fix the system**

In recent years, the concept of CE has received increased attention both among policymakers, scholars and the private sector as a strategy which can contribute to sustainable development - a concept which was first defined by the 1987 Brundtland Commission Report as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987, p. 43). Furthermore, there have been several contributions highlighting the potential of applying CE to food systems, both from academics (e.g., Jurgilevich et al., 2016; Osorio et al., 2021; McCarthy et al., 2019) and from private and civil society organizations such as the Ellen MacArthur Foundation (Ellen MacArthur Foundation, n.d.) and the Platform for Accelerating the Circular Economy (PACE, 2021).

The application of CE to food systems is also gaining momentum in the political sphere internationally. For example, the European Commission has put forward a strategy aimed at facilitating a transition to a more sustainable food system called ‘Farm to Fork’, where it is stated that the European Commission will take action to promote more circular approaches in the food system (European Commission, 2020).

### **2.2.1 The concept of circular economy**

Despite the broad application of CE, it is a concept understood in many different ways, and some further background on the concept will therefore be provided. CE is a concept heavily influenced by the work of Boulding (1966), where he argued that the Earth should be seen as a closed-loop system with limited capabilities. Only by applying this view, the economy and the environment could coexist in equilibrium, he argued. In the last decade, the CE concept has grown in popularity, much due to the Ellen MacArthur Foundation that has played an important role in framing and curating the topic through various reports (Ellen MacArthur Foundation, 2013;2015;2017). Also in the academic sphere, the focus on CE has greatly accelerated over the last couple of years.

The increased use of the concept has happened without a commonly accepted definition. This has led to well over 100 definitions of the concept with various approaches to what circularity in the economic system entails, although the majority of them refer to the creation of environmental quality, economic prosperity and social equality (Murray et al., 2017; Kirchherr et al., 2018; Geissdoerfer et al., 2020). However, critics claim that the many interpretations of

the concept of CE contributes to a lack of coherence, and that conceptualizing CE in significantly varying ways might lead to a collapse of the concept altogether (Kirchherr et al., 2018). Through reviewing 114 definitions of CE, Kirchherr et al. (2018) have put forward a definition that encompasses the main concepts in the various definitions reviewed, which reads as follows:

A circular economy describes an economic system that is based on business models which replace the 'end-of-life' concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes, thus operating at the micro level (products, companies, consumers), meso level (eco-industrial parks) and macro level (city, region, nation and beyond), with the aim to accomplish sustainable development, which implies creating environmental quality, economic prosperity and social equity, to the benefit of current and future generations. (Kirchherr et al., 2018, p. 224-225)

Several scholars argue that the *systems perspective* is a core principle to the conceptualization of CE, as it is central to understanding how deep transformative change can be achieved (Kirchherr et al., 2018; Iacovidou et al., 2021). For example, Iacovidou et al. (2021) argue that five interconnected subsystems must be considered for transitioning to a CE. These systems relate to regulations and governance; resource flows; business and the market; innovation and infrastructure; and user practices. Furthermore, Kirchherr et al. (2018) argue that proponents of the systems perspective in CE often highlight that a CE transition must happen at both the macro, meso, and micro level. The Ellen MacArthur Foundation also holds a strong system perspective in their approach to CE and refers to it as a systems solution framework based on three overarching principles, namely 1) eliminating waste and pollution, 2) circulating products and material (at their highest value), and 3) regenerating nature (Ellen MacArthur Foundation, n.d.).

Critics argue that there are some challenges to the concept of CE (Skene, 2018; Korhonen et al., 2018; Murray et al., 2017). One critique is that CE projects sometimes lead to problems being shifted from one part of a system to another because global net sustainability is not considered in outcomes (Korhonen et al., 2018). This perspective emphasizes the need for applying a systems perspective when considering CE approaches. Furthermore, Murray et al.

(2017) pose the critique that the CE concept often has been silent on the social dimension of sustainable development, and it often remains unclear how CE will contribute to social equality. The authors further argue that only by defining and including societal needs in the basic formulations, all three pillars of sustainable development can be considered. However, as the definition by Kirchherr et al., (2018) cited earlier in this chapter demonstrates, definitions of CE encompassing the social component of sustainable development exist. Nevertheless, it will be important to assess what encompassing the social component implies in practice in specific CE initiatives.

There is also one central critique of the feasibility of CE altogether, which relates to thermodynamic limits. This critique is based on the work of Georgescu-Roegen (1971), who pointed out that due to the second law of thermodynamics - entropy - recycling will always generate waste and side products due to the need for energy (entropy increases, exergy decreases). This means that CE processes, which are also material and energy using processes, will ultimately result in unsustainable resource depletion, waste generation, and pollution if the physical scale of the economy grows (Korhonen et al., 2018). Other scholars (e.g. Ayres, 1999) have contested this perspective, by arguing that due to flows of solar energy being infinite (at least for as long as humans inhabit the earth) and not just renewable, it could in theory be possible to harness this energy and use it in processes relating to CE. However, this would require enormous efforts in terms of recovering and processing dissipated materials and nutrients, meaning that although fully closing the circle could be achieved in theory, it still remains a rather distant future. Nevertheless, creating more circular systems as an alternative to the current global linear material throughput of the economic system, still holds the potential of significantly reducing virgin resource use and climate gas emissions. This furthermore points back to the need to consider the global net environmental sustainability of CE initiatives (Korhonen et al., 2018).

### **2.3 Approaching the Norwegian food system**

The need to change the food system in order to reduce environmental pressures, both globally and nationally, is well-recognized in Norway. As a response to this, several initiatives have been launched, especially in recent years. The creation of a multi-stakeholder Voluntary Industry Agreement on food waste reduction in 2017 was a strong signal from the food system

recognizing the responsibility of contributing to change. The aim of the Agreement is to reduce food waste in Norway by 50% by 2030 (Regjeringen, 2017).

Although still in novel stages, CE is starting to be recognized as an explicit strategy for creating a more sustainable food system in Norway by both political, economic, and civil society actors. According to The Circularity Gap Report Norway, adapting to a more circular food system is a key intervention for improving the overall circularity of the Norwegian economy (Circle Economy & Circular Norway, 2020). In the Circular Economy Strategy of the Norwegian government, several issues in the food system have been addressed, such as agricultural production and food waste (Klima- og miljødepartementet, 2021). Major companies working within the food system are also addressing CE in their sustainability strategies and reporting (e.g., BAMA, n.d.; Coop, n.d.; Rema 1000, 2021).

The Platform for Accelerating Circular Economy has defined three objectives for a circular food economy: food production is done in ways that regenerate nature; food is not being lost or wasted; and resources that are commonly wasted are used productively (PACE, 2021). As this thesis is focused on the food system post-harvest, the two last objectives are of most relevance although all of the objectives are interlinked.

In Norway, food loss and waste was assumed to amount to 454 350 tonnes in 2020. The majority of food waste stems from private households (48%), but the numbers are also high in various parts of the value chain, especially in the food industry (19%), supermarkets (15%), and in agriculture (9%, although it is assumed that numbers on food loss and waste are underreported) (Regjeringen, 2021a). Food waste is defined as “all usable parts of food produced for human consumption, but which are either thrown away or taken out of the food chain for purposes other than human consumption, from the time when animals and plants are slaughtered or harvested” (Regjeringen, 2017, p.2, my translation).

In line with global numbers on food waste in various product categories, fresh fruit and vegetables is among the categories being wasted the most in the Norwegian food system (FAO, 2019; Regjeringen, 2021a). In agriculture, fruit, berries, vegetables, and potatoes constitute by far the largest waste category, but exact numbers remain uncertain due to the lack of good data. Within the food industry, fresh fruit and vegetables is the second largest category of food wasted, amounting to 16% of total waste. In the wholesaler component, fresh fruit and



vegetables make up 76% of food wastage. However, only a small fraction of total food waste throughout the value chain happens in the wholesaler component. Also in supermarkets, fresh fruit and vegetables is one of the biggest categories of food being wasted, amounting to 34%. In the food service, there are many uncertainties in the collected data on what food categories are wasted, but it is assumed that fruit and vegetables are among the most wasted categories. Also in households, one of the two largest categories of food wasted was fruit and vegetables (Regjeringen, 2021a).

## **2.4 Barriers and drivers to a circular economy in the food system**

Moving from theory to practice is still a challenge for the CE, and the methodologies for actually delivering a CE remain somewhat unclear in many cases. In order to overcome this challenge, it is important to map out the factors which constitute the drivers and barriers to the transition to a CE in the food system. The specific barriers and drivers of CE approaches to the food system are much less assessed than those on CE in general. However, some contributions exist in both the gray and peer-reviewed literature. Key identified barriers and drivers will be presented in this section. Furthermore, in relation to the Norwegian food system, there are some contributions relating specifically to food waste reduction in the value chain, although not referred to under CE initiatives or focusing on vegetables in particular. These findings will be explained separately after the review on barriers and drivers which are not specific to the Norwegian context, in order to make clear what factors are currently considered in the Norwegian food system.

A central barrier highlighted in the literature on both CE in general as CE in agri-food systems, is the barrier of finance and high investment costs (Mehmood et al., 2021; Govindan & Hasanagic, 2018; De Jesus & Mendonça 2018; PACE, 2021). Govindan & Hasanagic (2018) point out that companies are profit-driven, and thus profits are often considered before environmental impacts. This is a barrier as CE approaches often require high investment costs and uncertain returns. This argument was also made by Mehmood et al. (2021). Lacking tools to assess the value of novel production methods adds on to the financial risk and lack of finance, according to PACE (2021). Even more, De Jesus & Mendonça (2018) found that these financial factors could act as barriers even when CE solutions were technically feasible.

Nevertheless, the lack of necessary infrastructure, facilities, and technology is also a reality (Mehmood et al., 2021; Govindan & Hasanagic, 2018; De Jesus & Mendonça 2018; PACE, 2021). Mehmood et al. (2021) argue that in food systems, this barrier is especially relevant to waste treatment, while PACE (2021) furthermore argues that the agriculture and food sectors are often characterized by traditional practices due to the number of stakeholders involved.

The lack of knowledge, awareness and skills also constitute pressing barriers (Mehmood et al., 2021; Govindan & Hasanagic, 2018; Hamam et al., 2021). In the prolonging of this, PACE (2021) argues that information by itself is not enough. It is pointed out that loads of resources have been spent on information campaigns, but that many of these have failed due to a lack of consideration about the actual choices and engagement of those these campaigns have sought to influence.

Concerning drivers, several authors emphasize the importance of governmental policies and incentives (Mehmood et al., 2021; Govindan & Hasanagic, 2018; Hamam et al., 2021; PACE, 2021). De Jesus & Mendonça (2018) found that globally, CE is driven by various social, regulatory, and institutional factors. They emphasize that policymakers have a crucial role in framing institutions relating to e.g., infrastructure and legal set-ups. However, they argue that in institutional framing, it is necessary to develop a strategic, consistent roadmap in order to avoid contradictory incentives. Similarly, Govindan & Hasanagic (2018) found that governments have an important role in the implementation of CE in supply chains, and they should therefore make laws and policies as well as make financial contributions to help businesses realize a CE implementation. PACE (2021) argues that the most important role of Governments concerns increasing coordination and empowering stakeholders to deliver shared strategies.

Increasing awareness, both within the food system and among consumers, is also identified as a central driver (Hamam et al., 2021; De Jesus & Mendonça, 2018; PACE, 2021; Neves & Marques, 2022). Increasing awareness can furthermore be fueled by targeted governmental policies. For example, Neves & Marques (2022) found that education and young age are drivers for awareness and actions supporting CE, and thus argue that policies should especially target older and low-educated people.

Furthermore, strong cooperation and collaboration between stakeholders is emphasized as an important driver (Hamam et al., 2021; PACE, 2021). PACE (2021) argues that for all the critical barriers they have identified, collaboration is needed to overcome all of them. In addition to various stakeholders in the private, political, and civil society sphere, they also point to the need for collaboration across government functions. This is crucial in order to facilitate the implementation of CE practices in food systems.

Moving on to factors specific to the Norwegian food system, a report from the Norwegian Institute of Bioeconomy Research (NIBIO) has identified barriers to and measures for complying with the Industry Agreement on food waste reduction based on inputs from actors in the food industry and in the supermarket chains (Stensgård et al., 2019). For the food industry, consumer demands are pointed to as one of the main barriers. The high standard demanded by consumers translates into strict standard requirements for quality further out in the value chain, either from supermarkets, food service or consumers. In contrast to food waste stemming from production defects, this is seen as a barrier where the industry does not hold direct control over the cause for waste, because they have to follow the requirements. It is argued that increased collaboration between farmers, food industry, wholesalers, supermarkets and the food service sector is needed to reduce food wastage, as well as cooperative efforts for making consumers accept suboptimal produce. An additional barrier being emphasized by the food industry, is the high investment cost for measures to reduce food waste, such as new production lines and machines.

In the supermarket chains, a key identified barrier was that common solutions for reducing food waste for certain product groups, including fruit and vegetables, were not economically sustainable due to the lack of logistics systems and outlets, as well as requiring manual labor. The report also states that the supermarket chains see it as unlikely to succeed in using large fractions of wasted vegetables as human food through donation and price reduction, and that the best solution is probably using the food waste for animal feed. Another barrier mentioned by the supermarket chains, is that measures to reduce food waste involving assortment and exposure might lead to consumers choosing other supermarkets, which thus affects their competitive conditions (Stensgård et al., 2019).

In relation to measures, businesses in the food industry pointed to the need for public financial support for high investment costs, as well as economic incentives for compliance, such as taxes

on food waste, taxing businesses that do not comply with the goals of the agreement or rewards for those who do comply. A possible measure mentioned by the supermarket chains is excluding animal feed from the official food waste definition (like donated food is). This is to ensure more food ends up as animal feed than biogas, which is regarded as higher use of resource value (Stensgård et al., 2019).

Both businesses in the food industry and the supermarket chains emphasized that the Voluntary Industry Agreement for food waste reduction has allowed for finding, evaluating and choosing effective measures for reaching the goal. However, they claimed that it would be unfortunate if this agreement came to be enforced by political regulations, as this would reduce the flexibility that these actors perceive as crucial (Stensgård et al., 2019). In a study on Norwegian food waste governance, Szulecka & Strøm-Andersen (2022) argue that contrary to established myths about businesses being unwilling to carry unnecessary burdens, their findings show that actors in the food system can be a driving force for self-regulation. They however point out that pressures from political actors and civil society were necessary for institutionalizing the self-regulation in the Norwegian food system, as well as the timing of it.

In the Government platform of the current Government in Norway, it is stated that a Food Waste Act will indeed be created (Regjeringen, 2021b). This has been discussed for a long time, and businesses in the food industry and in the supermarket chains have emphasized that in order to succeed with such an Act, it will be necessary to secure a good system for donations of surplus food in regard to logistics, predictability, food safety and quality (Stensgård et al., 2019). Although Szulecka & Strøm-Andersen (2022) found that the self-regulation practice in the Norwegian food system had proven to give some results, they point out that the government might need to be involved in order to increase ambition and compliance, and aid with coordination issues. This is especially needed when the desired waste reduction levels move past only being a win-win concept, and more systemic changes are needed. They point out that some central issues to consider for such systemic changes include facing consumer expectations concerning product availability and variation, changing sales practices, assessing retail price policy, food safety standards, and farm subsidies.

To my knowledge, there is no peer-reviewed literature that specifically focuses on a transition to a CE for vegetables in the Norwegian food system. As every micro system of individual food product categories consists of specific economic processes, actors, technologies, regulations,

norms, and conventions, I hope to build on the existing literature by doing a more in-depth assessment of factors affecting a CE transition in the value chain for vegetables in the Norwegian food system.

## **3.0 Theoretical concepts and frameworks**

In this chapter, the theoretical concepts and frameworks applied in this study will be described. As discussed in the background chapter, a system perspective is by many considered key when assessing the factors affecting a transition to a CE. The concepts and framework in this thesis are chosen based on this perspective. In order to guide my study, I will apply the integrated framework for a sustainable economy developed by Vatn (2021) as the theoretical lense in my analysis. This framework is a tool for describing and analyzing economic structures and processes, based on important insights from ecological and institutional economics. It considers the actors and institutions within an integrated system, as well as the interactions between them. The point of using this framework is to capture significant elements of the complex food system in Norway with a suitable degree of simplification. The aim is to create analytical structures which can be useful when trying to choose which institutions can facilitate a CE transition in the value chain for vegetables in Norwegian food system. For the purpose of aligning the framework with the research focus of this project, a few adaptations to the framework have been made. Additionally, I will apply a definition of CE, as well as a food waste hierarchy framework.

### **3.1 Central concepts**

In this section, the concept of CE and the food waste hierarchy framework will first be defined. Following this are some definitions of central concepts in the integrated framework for a sustainable economy. It is especially important to explain how the concept of institutions is understood in this framework, as this is a concept with varying meanings ascribed to it depending on the theorist and field of study. Next, the concept of power and how it relates to institutions will be explained.

#### **3.1.1 Circular economy**

In this study, the definition of CE that will be applied is one developed by Kirchherr et al. (2018). The definition is based on a review of more than a hundred definitions of CE, and encompasses the main concepts in the various definitions reviewed. It reads as follows:

A circular economy describes an economic system that is based on business models which replace the ‘end-of-life’ concept with reducing, alternatively reusing, recycling and recovering

materials in production/distribution and consumption processes, thus operating at the micro level (products, companies, consumers), meso level (eco-industrial parks) and macro level (city, region, nation and beyond), with the aim to accomplish sustainable development, which implies creating environmental quality, economic prosperity and social equity, to the benefit of current and future generations. (Kirchherr et al., 2018, p. 224-225)

This definition thus encompasses the 4R framework (reduce, reuse, recycle, recover), a waste hierarchy ranking the various Rs, a systems perspective, business models, and consumers. Furthermore, it makes it explicit that the aim of CE is creating environmental quality, economic prosperity, and thus ultimately sustainable development.

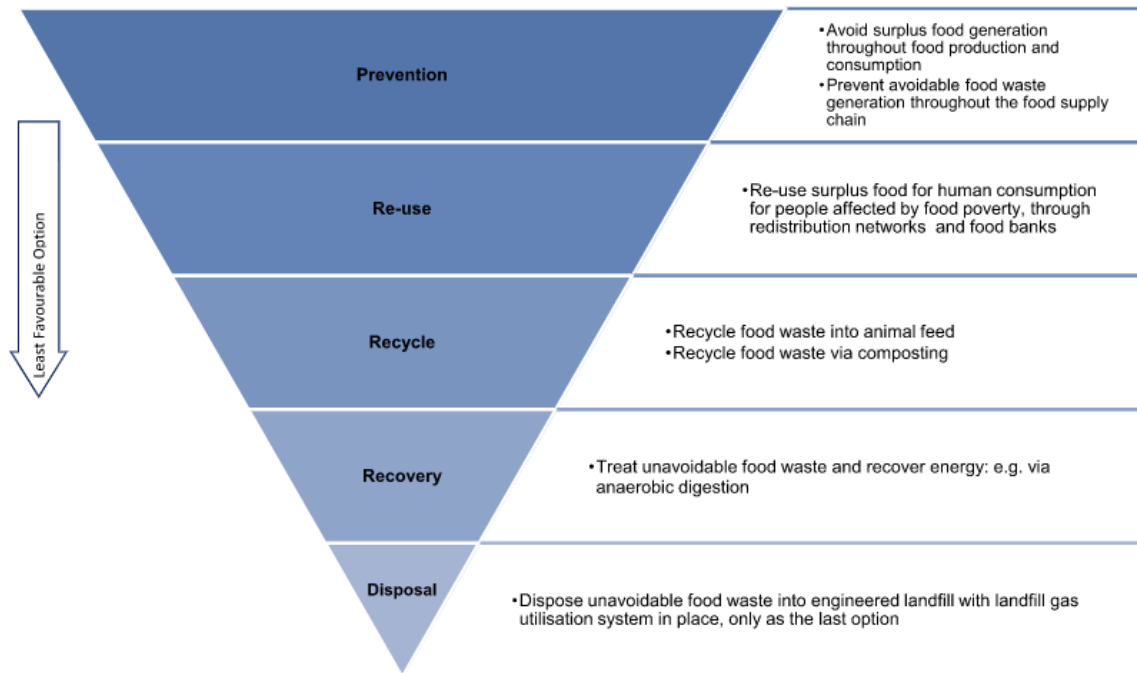
Additionally, the overarching principles of CE as a systems solutions framework, as proposed by the Ellen MacArthur Foundation, will be applied. The three principles are: 1) eliminating waste and pollution, 2) circulating products and material (at their highest value), and 3) regenerating nature (Ellen MacArthur Foundation, n.d.).

### **3.1.2 Food waste hierarchy**

For the purpose of addressing how food waste can be circulated at the highest possible value more explicitly than what the R's in the CE definition proposes, an additional waste framework will be applied. The food waste hierarchy framework developed by Papargyropoulou et al. (2014) is a tool for a more holistic approach to handling the food waste issue. It aims at identifying and prioritizing the options for minimizing and managing food surplus and waste throughout the food value chain, based on all three dimensions of sustainability (economic, environmental and social).

**Figure 1**

*The food waste hierarchy*



*Note.* From “The food waste hierarchy as a framework for the management of food surplus and food waste,” by E. Papargyropoulou, R. Lozano, J. K. Steinberger, N. Wright and Z. bin Ujang, 2014, *Journal of cleaner production*, 76, p. 106-115. Copyright 2014 by Elsevier Ltd.

### **3.1.3 Institutions**

According to Vatn (2015), institutions can be defined as follows:

*Institutions are the conventions, norms and formally sanctioned rules of a society. They provide expectations, stability and meaning essential to human existence and coordination. Institutions support certain values and produce and protect specific interests. (Vatn, 2015, p. 78)*

Institutions can be distinguished into formal institutions, meaning official rules and laws, and informal institutions, referring to norms and conventions. The function of institutions is to create order, both through facilitating coordination and through taking sides in conflicts. They are often based on certain values and interests. For example, the law concerning parliamentary and local government elections in Norway is a formal institution based on democratic values. The value foundation thus has an impact on the results of processes.



Following Vatn's understanding, institutions are not only external rules created by people - they are also 'producing' individuals by shaping their values and preferences (Vatn, 2015). This perspective is quite aligned with the influential structuration theory deriving from the seminal work of sociologist Anthony Giddens, where structure and action are seen as necessarily related and not opposing each other (Giddens & Sutton, 2017). Institutions and actors thus co-exist in a circle of influence, meaning that actors influence institutions and institutions influence actors. Institutions also define whether a more individual rationality or social rationality should support actors' decisions in various situations. The former refers to maximizing individual utility, while the latter refers to a 'we' rationality (what is seen as the right thing to do for the group) or a 'they' rationality (what is right to do for others) (Vatn, 2015). In some institutional systems, the institutional environment tends to support individual rationality, such as in the market (e.g., utility maximization), while in others, such as in the family, social rationality is often more prevalent (e.g., care taking, reciprocity).

#### **3.1.4 Power**

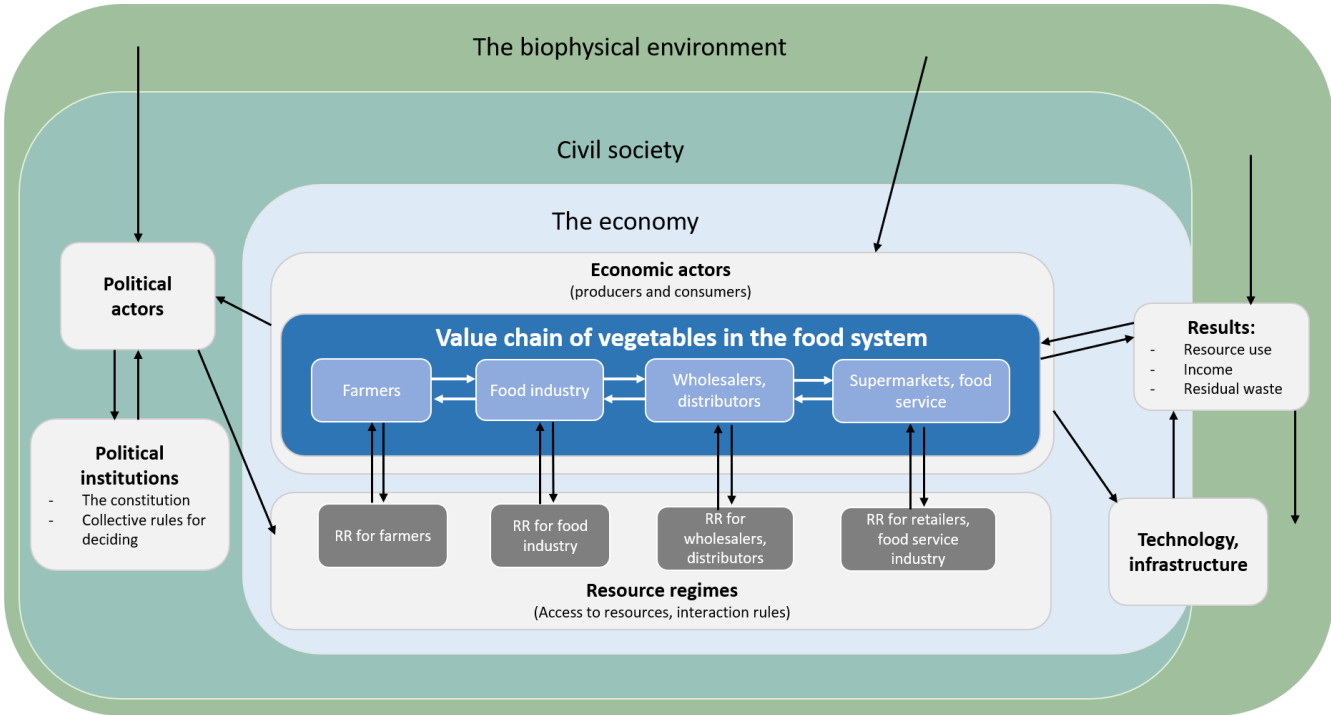
Institutions are central in the shaping of power relations and as sources of power. According to Vatn (2015), institutions affect power relations in three ways. With *epistemic and normative power*, actors have the capacity to influence people's understanding of 'what is right', through institutionalizing certain perceptions and knowledge on preferences, self-understandings, interests and values in the conventions and norms of a society. *Positional power* on the other hand, regards the access one has to resources and to positions in decision-making processes. Lastly, *coordination power* relates to the ability to coordinate activities in a society. Coordination is often a complex challenge in any society, however to which degree depends on institutional and organizational structures. The power types are interlinked and having much of one type of power can be a gateway to acquire other types of power.

### **3.2 The integrated framework for a sustainable economy**

The integrated framework by Vatn (2021) combines a view of the economy as embedded in nature with *governance structures* which consists of institutions and actors, and thereby demonstrates the interplay between ecological, political and economic processes. In addition, variables such as technologies and infrastructure as well as patterns of interaction are central. For this thesis, some adaptations have been made to Vatn's integrated framework in order to

better answer the research questions of this study. As the aim of this research is to analyze barriers and drivers for a transition to a CE for vegetables in Norway based on perspectives from leaders in businesses representing the whole value chain, it was necessary to make the whole value chain in the economic sphere explicit, as the structures, processes, and interactions between these are pivotal. The arrows between the various groups of actors relate to the stream of both resources and interaction.

**Figure 2**  
*The integrated framework for a sustainable economy*

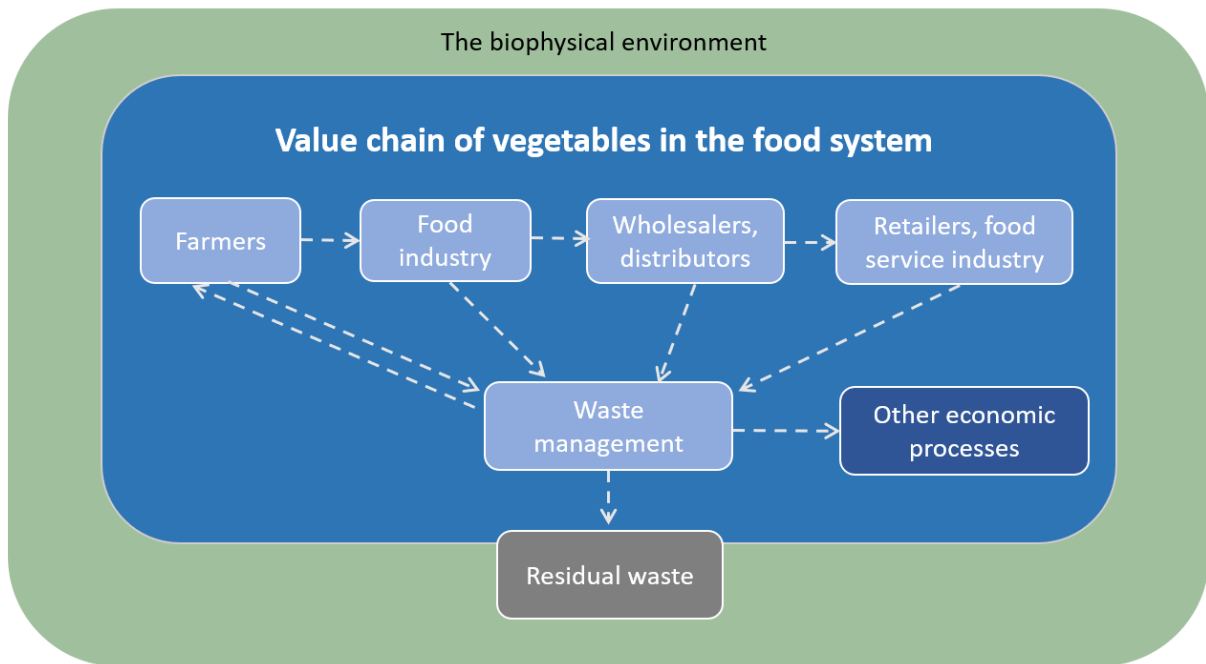


*Note.* Adapted from “Bærekraftig økonomi: Innsikt fra økologisk og institusjonell økonomi” by A. Vatn, 2021, Fagbokforlaget. Reprinted with permission.

As an extension to the above figure, the figure below has been developed to demonstrate the flow of resources throughout the value chain. Furthermore, it shows that food waste occurs in all components of the value chain, and while some of the managed waste is added back into the value chain or goes to other economic processes such as energy production, parts of the food waste also end up as residual waste in the biosphere. This is especially the case when the food waste is not sorted for recycling.

**Figure 3**

*Flow of resources throughout the value chain*



### 3.2.1 Governance structures

Governance structures consist of both actors, with their goals and motivations, capacities, rights and responsibilities, and institutions which govern the use of resources and the interaction at various levels (Vatn, 2021).

#### Actors in governance systems

According to the framework, there are three main groups of actors in any governance structure: economic actors, political actors and civil society actors. However, the same individual or organization can act as both an economic and political actor. Furthermore, all individuals are part of civil society - what type of actor a person or organization is, thus depends on the role one has in a given context.

**Economic actors** hold the rights to productive resources and are often grouped as producers and consumers. In neoclassical economic theory, the goal of producers is thought to be maximizing profits, while the goal of the consumer is assumed to be maximizing utility. Producers might be private, community based or state, and can be organized as firms, cooperatives, public managements, private households, and individuals. Central economic

actors in this study are farmers, wholesalers, food industry businesses, restaurants, supermarkets, and waste management businesses.

**Political actors** are the actors with the authority to define the resource regimes framing the actions of economic actors (see further down) as well as the institutions governing political processes. At the national level, the prominent type of political actors are public authorities on state levels. At a regional level, political actors are typically municipalities. They have significant power in matters concerning constitutional and collective-choice rules in a society, as well as the power to define resource regimes and act as a third-party authority between economic and political actors. Central political actors in this study are e.g., governmental bodies such as the Ministry of Agriculture and the Ministry of Climate and Environment, and municipalities around Norway.

The category **civil society actors** encompasses a range of different actors, such as individuals, nonprofit organizations, research units and the media. These actors offer legitimacy to political actors and determine the normative basis for society. The relevance of various civil society actors depends on the given context. Civil society actors that are relevant to this study are for example the media and research units focused on e.g., food production, CE and sustainability.

#### Institutions in governance systems

There are three main categories of institutions in the governance structure: resource regimes, political institutions and the institutions of civil society.

**Resource regimes** can be defined as systems of institutions governing economic processes. Two systems of institutions are key: the rules of access to resources, and the rules of interaction between the various actors taking part in the economic process. As understanding the functions of the resource regimes is at the core of analyzing economic structures and processes, an extended explanation will be provided for this concept.

The first key element of a resource regime, *the rules of access to resources*, concerns property and use rights, which determine “the ‘access’ to benefit streams from a resource” (Vatn, 2015, p. 135). Property and use rights cover both formal institutions, such as laws and company rules, and informal institutions, meaning relevant norms and conventions on how the rights are being practiced.

In line with Schlager and Ostrom (1992), Vatn (2022) distinguishes between five sub-elements of property rights: *access*, meaning the right to enter a physical property; *withdrawal*, which is defined as the right to obtain the ‘products’ of a resource, both the goods and the waste; *management*, referring to the right to regulate the use of the resource and its production abilities; *exclusion*, meaning the right to define who has access to the resources and how this right might be transferred; and *alienation*, which can be defined as the right to sell or lease the resource to others, as well as the right to transform the resource, including destruction and consumption. Having full property right to a resource includes all sub-elements.

Furthermore, property and use rights can be divided into four idealized categories: private property; common property; public property; and open access. *Private property* refers to an individual right. *Common property* is likewise private, but for a group of co-owners. *Public property* covers state, municipality, and county property. *Open access* means everybody has access and nobody has particular property rights. Today, more and more resources are covered by the first three categories. This can be due to a wish to control the values the resources represent, or to regulate the use of the resource to prevent exhaustion. Furthermore, the various property rights support different types of motivation - private companies, cooperatives and public administration units have different purposes and goals. Nevertheless, motivations can still be similar across categories as well as be different within the same category.

The second key system of institutions, *Rules of interaction*, covers the rules for coordination of the use of resources and the products being produced. Products refer to goods but also side-effects, such as waste production. For example, the rules of interaction concern what can be done with the waste being produced in a production process.

The rules of interaction can be divided into four main categories: trade, command, cooperation rules and no rules. *Trade* is the interaction form in markets, typically in the form of exchanging goods and services against a payment. In its idealized form, trade is regarded as a voluntary form of exchange. However, access to resources determines one’s position in the market, and hence the power to make a trade happen or not. The position of an actor in a market and the rules of trade are also dependent on market regulations.

*Command* is founded on hierarchical power and is the main principle of interaction within businesses and in public administration units. Here, the line of command has the ultimate power to decide on the use of resources. Command can also be found between actors. For example, public authorities have the power to command other actors in order to create structures for public funding and payments (taxes and subsidies) or to protect property rights for community purposes. Public authorities also have the right to define laws that regulate the interaction between the public and private sector and within the private sector. Command also exists between companies, for example in vertical integration where a company holds power over its upstream suppliers and its downstream buyers.

*Cooperative interaction rules* are typically informal rules (norms and conventions) aimed at strengthening relationships within or between groups. For example, such interaction rules can be responses to challenges regarding how companies in the same market may best interact and organize their activities.

The fourth category, *no rules*, implies that there are no commonly defined ways to interact. This implies that individuals or groups are free to do as they want despite consequences for others. This is for example the case when companies create side-effects such as pollution but are not required to take responsibility for it. In this example rights are implicitly given to polluters, which shows that no rule is also a rule.

*Political institutions* are the rules governing the political processes. This concerns constitutional rules which govern the power and relationship of representatives in relation to citizens. It also includes collective-choice rules which structure the policy processes. Some key rules in democratic states include citizen participation, voting rights and division of political power.

*Institutions for civil society* are characterized by much less formalized structures than in the political sphere. These institutions are to a large degree defined by norms for appropriate interaction between fellow citizens in a given society. However, formal rules can also be found in this sphere, for example in the right to free speech and the right to organize. Interests in civil society are central for facilitating public debate and influencing political processes.

### Technology and infrastructure

Technology and infrastructure also have central roles in the integrated framework, as they are components that influence the economic and political structures and processes. Technology and infrastructure also impact choices among different actors. If policymakers wish to steer technological development, this can be achieved through changing the resource regime in order to enable conditions for technology production among economic actors (Vatn, 2015).

## Results

The results of economic structures and processes can be summed up as resource use, income and waste produced (Vatn, 2021). Resource use can be seen as what resources are extracted for the economic processes in the value chain. In the case of this study, this relates to the vegetables as well as resources related to infrastructure, energy and packaging. Income regards what economic actors earn from economic processes, versus what the costs are for maintaining these. The waste produced is the residual waste stemming from these processes, meaning the waste that is not recycled back into new economic processes.

## The effect of governance systems on environmental behavior

There are some central mechanisms behind how governance systems influence economic results and the quality of the biophysical environment. These include the distribution of rights and duties, the level of transaction costs, and the shaping of perceptions and of motivations. *Rights and duties* concern how one actor's actions affect the opportunities of others, such as another actor's right to resources or rights in regard to side-effects or so-called production externalities. *Transaction costs*, which can be defined as the costs of establishing, maintaining, and using a governance system (Vatn, 2015; 2021), affect to a large degree the existence and extent of environmental issues. If it is difficult to identify where a problem in the system lies, it might be very costly to implement appropriate measures which reduce the disadvantages. The way that governance systems *shape perceptions* is also essential, as our actions are guided by our motives and perceptions of how things are. We tend to perceive things differently depending on our acquired knowledge, our interests and the field we operate in. As we perceive things differently, this might as well result in conflicts. The perceptions that win their way through as the 'truth' in society will in the end affect what politics get support, and what strategies are accepted for solving societal problems. Lastly, governance systems also *shape motivations and preferences*, hence our rationality. This points to the fact that motivations and preferences are shaped through social processes in the cultures we are part of. If a governance system encompasses instruments appealing to individual rationality, affected actors will likely become

more preoccupied with individual utility (Vatn, 2015). Nevertheless, the fact that motivations and preferences are shaped through social processes also indicates that they are subject to change (Vatn, 2015; 2021).



## 4.0 Methods

In this chapter, the methods used for collecting and analyzing the data, as well as the decisions made both prior to and during the research process, will be explained. In addition, the chapter encompasses a description of the ethical considerations and limitations of this study.

### 4.1 Research design

This study is based on a case study design. This design is understood in various ways in the literature, but the following definition by Simons (2009) is one that exemplifies that my research is well-suited under this design approach: “Case study is an in-depth exploration from multiple perspectives of the complexity and uniqueness of a particular project, policy, institution, program or system in a “real life” context”. (Simons, 2009, p. 21) The value chain for vegetables in Norway thus constitutes the system which is the case being studied.

#### 4.1.1 Characteristics and delimitations of case

In the following, some central characteristics and delimitations of the case under study will be explained, in order to make clear what is implied when referring to certain concepts later on in this thesis.

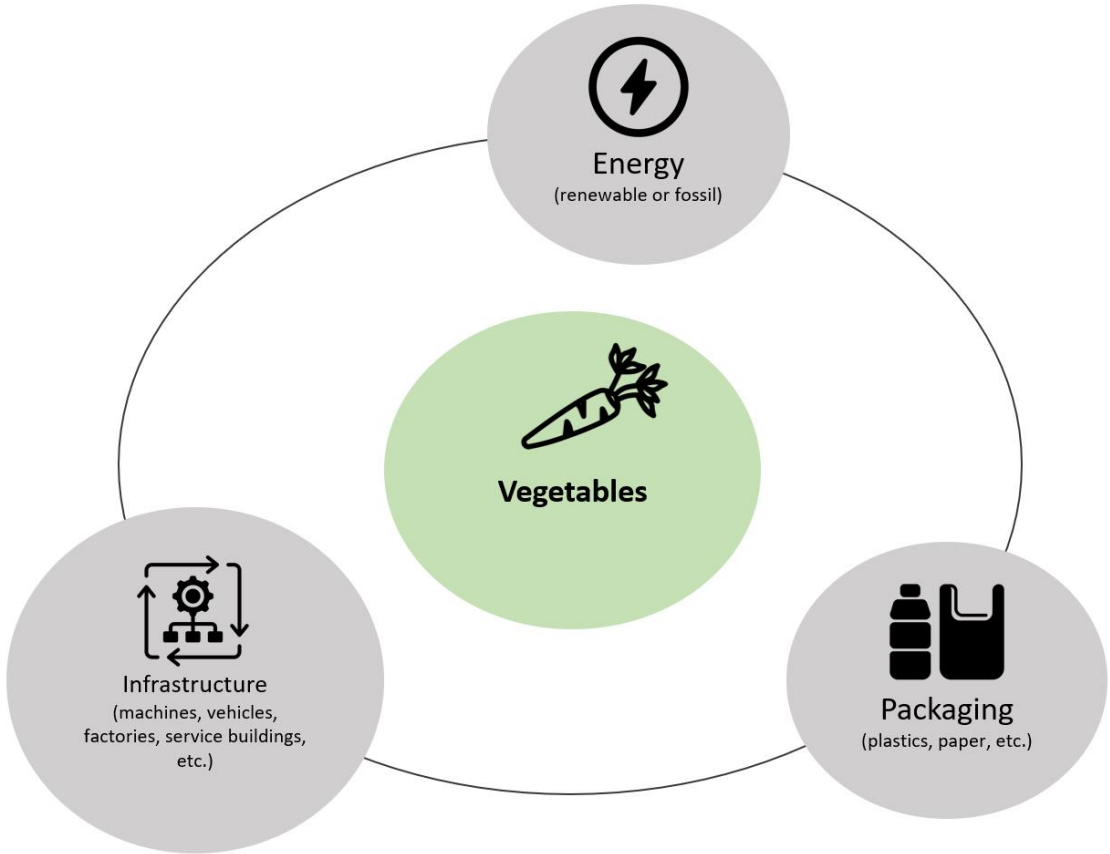
**Vegetables:** When referring to vegetables in this thesis, this mainly concerns fresh vegetables that are in their harvested form or have undergone minimal processing for convenience, such as washing, cutting, and packaging. Vegetables are typically sold in three classes based on standard, namely class extra, class 1 and class 2 (Standard Norge, n.d.). All classes are encompassed when referring to vegetables in this study. The delimitation of focusing on fresh vegetables was made because highly processed vegetables go through different processes and hold other characteristics relating to durability and ultimately waste patterns. Therefore, institutions and actors which are relevant for fresh vegetables are not necessarily relevant for highly processed vegetables.

**Value chain:** The vegetable value chain is here understood as the network of stakeholders involved in producing, processing, transporting, and selling vegetables to consumers, as well as the waste managers handling the vegetables being wasted throughout the value chain and in households. This implies that the economic processes investigated in this study are delimited to

those happening post-harvest. This is because including an assessment of barriers and drivers to pre-harvest processes would be exceeding a suitable scope for a master thesis of 30 ECTS.

**Supporting resources:** The vegetable is not the only resource involved in economic processes throughout the value chain. Some key resources supporting the economic processes throughout the value chain are energy (either renewable or fossil), packaging (typically plastics or paper/cardboard), and infrastructure (such as machines, vehicles, factories, and service buildings). Although vegetables are the main focus of this thesis, the supporting resources are central to address as they are pivotal for the system. Transitioning to a CE for vegetables requires that also these resources are sourced, managed, and disposed of according to CE principles.

**Figure 4**  
*Illustration of supporting resources*



## **4.2 Research strategy**

For this study, a qualitative research strategy has been applied. The defined research questions as well as the case study design could however allow for both a quantitative and qualitative research strategy (Bryman, 2016). Nevertheless, the overarching objective of this research has been to bring forward various perspectives and reflections. This is because there is little research on the specific topic, and therefore little data on what specific barriers and drivers of the transition to a CE for vegetables might be according to businesses working in the Norwegian food system. A data collection method which allowed for exploration and new perspectives instead of testing assertions was therefore important. The chosen research strategy restricts the possibility to generalize to the wider population, but rather allows for a more comprehensive understanding of the nuances of perceived barriers and drivers in the transition to a CE for vegetables.

This research is furthermore underpinned by a critical realist position. Critical realism deviates from both positivism and constructivism and assumes that ontology (meaning what is real) cannot be reduced to epistemology (our knowledge of reality). Human knowledge can only capture fractions of a deeper and vaster reality. However, critical realists take the position that some knowledge can be closer to reality than other knowledge. Knowledge can be gained through theories that help us identify and analyze causal mechanisms which drive social phenomena, activities, and events. This makes critical realism a useful approach for analyzing social problems and suggesting solutions for social change (Fletcher, 2017).

In line with my critical realist position as a researcher, the mode of reasoning in this study is retrodution. Retrodution aims at identifying the essential contextual conditions for a specific causal mechanism to come to be and to result in the empirical patterns one can observe (Fletcher, 2017). Thus, retrodution moves from ‘the manifest phenomena of social life, as conceptualized in the experience of the social agents concerned, to the essential relations that necessitate them’ (Bhaskar, 1979, p. 32).

## **4.3 Sampling approach**

For this research, a purposive sampling strategy was applied. This indicates that the sampling was done in a strategic manner in order to ensure that respondents were of relevance to the

research questions and thereby able to answer them (Bryman, 2016). I have purposely sampled people with leader functions in businesses working within the different components of the value chain for vegetables in the Norwegian food system. The aim has been to secure perspectives from all main components of the value chain. My assumption was that this would maximize the likelihood of accessing variation as well as highlight common experiences in the food system, more than only collecting data within one component would.

The main sampling approach of this study was generic purposive sampling and a priori, meaning that the criteria for sampling units was set prior to the data collection (Bryman, 2016). This study required three levels of sampling: first, the food system in Norway was chosen as the context of examination. The second level of sampling was of components of the value chain for vegetables within the Norwegian food system. As this study takes on a systems approach, it was important to sample all the main components in the value chain for vegetables, including farmers, wholesalers, food industry, supermarkets and food service, and waste management. The third level of sampling in this study was the sampling of participants within each component of the value chain. In sum, two sampling criteria were applied to all respondents: 1) the businesses where respondents were employed had to work in the Norwegian food system, 2) respondents had to have a leader function in the business they work in.

Purposive sampling often involves more than one sampling approach (Bryman, 2016). In addition to the generic purposive sampling, snowball sampling was applied to complement the process. Snowball sampling refers to using people who are relevant to the research topic to establish contact with others (Bryman, 2016). This can be a fruitful approach when trying to get a hold of hard-to-reach populations, which proved to be the situation my case.

#### **4.3.1 Size and characteristics of samples**

Several considerations were made when deciding on the sample size for this research. The characteristics of each participant and the composition of the population were however more important than the sample size. It is necessary to note that some of the components in the value chain encompass a wide variety of small actors, while some groups consist of fewer, bigger actors. Sampling enough representatives to capture the whole breadth of characteristics in the components consisting of many small actors has not been possible due to the scope of this thesis. I strived for sampling at least two representatives from the components consisting of fewer, bigger actors, and at least three representatives from the components consisting of many

small actors in order to capture at least some variety within the group. Ensuring a variety of characteristics in the sample and thus triangulation of data sources is important in order to get a more complete understanding of the concepts being investigated (Krefting, 1991).

#### Sampling group 1: farmers

This group consists of farmers involved in vegetable production, as well as agricultural cooperatives. The population from which the sample is drawn is quite big and heterogeneous. Respondents have been purposely sampled based on different characteristics, such as production methods (e.g., open field cultivation, greenhouse farming, organic farming), organization, and geographical position.

#### Sampling group 2: food industry

In this thesis, the food industry refers to actors involved in sorting and processing procedures. However, as the focus of this thesis is on the value chain of fresh vegetables, the ‘minimally processed’ processes are in focus, as the product both entering and exiting these processes can be categorized as fresh. For more complex industrial processes, fresh vegetables enter these processes, but the product coming out will have changed character and thus category (e.g., through temperature treatment for preservation, adding ingredients such as spices, sweeteners, colors and preservatives). Companies and processes focused on the more complex processing are therefore not the main focus of this thesis.

#### Sampling group 3: wholesalers

This group consists of actors involved in the distribution and wholesale of vegetables to supermarkets and food service. Respondents have been purposively sampled to include both actors who deliver to supermarkets and food service.

#### Sampling group 4: supermarkets and food service

This group consists of actors delivering food to the end consumer. Although there is a wide variety of actors within this population, such as physical supermarkets, online retailers, restaurants, and canteens, they all have in common that their main customer is the end consumer, and thus they all have to consider consumer demands and preferences in their business operations. From this group, I purposely sampled respondents either based on the position of their business in the food system, or with the means to find various perspectives within the group based on specific business characteristics, for example online retail and fine

dining. Although supermarkets and food service are considered to be part of the same sampling group, they will be treated as separate components throughout this thesis as they sometimes are affected by different factors.

#### Sampling group 5: waste management

This group consists of actors who work with food and organic waste management. This includes various approaches, such as composting, biofuel production or using food waste as animal feed. Not sorted food waste is normally converted into energy through combustion (low value use).

#### **4.3.2 Recruitment**

The method for recruitment is also an important part of the sampling strategy. The recruitment process for this research started right after the study project was approved by The Norwegian Centre for Research Data (NSD) on 27.01.2022. First, information on potential respondents, such as position, company, component in the value chain for vegetables and contact information, was structured in a spreadsheet (a closed document encrypted with a password). From some of the biggest businesses in the food system, several relevant respondents were listed. This was because, within some components of the value chain, there are only a few big enterprises operating. I hypothesized that reaching someone within these businesses who would be willing to participate in this study might be difficult due to their position, but at the same time, I saw it as crucial to secure a perspective from someone within the major businesses operating in the food system.

Possible respondents were contacted by email or telephone. In both cases, information was given regarding my study program and University, the main focus of the research project, as well as a request to participate. In the cases where I didn't get a response within a week, I would follow up either by email, call or text message. In the cases where there was still no response after the follow up, I would try contacting a few people a third time, depending on their importance to the study.

In total, 35 possible respondents got a request to participate in my study. Some never answered the request nor the follow-up. A couple declined immediately, and a few were hesitant on whether or not they had the time and saw the relevance of participating. There were also some who directed me to other people within their business, who they believed to be better suited to

participate. Some were positive to participate in the study after the first request, while others needed more convincing and several rounds of phone calls or emails.

As mentioned above, snowball sampling has also been applied in this study to complement the generic purposive sampling. In some cases, snowballing was applied as a method to reach participants within businesses I had first tried to reach through a generic purposive approach. In other cases, participants would make me aware of new, relevant actors, and put us in contact. Snowballing proved to be very helpful in the recruitment process. In all requests where I could mention that someone had told me to contact them specifically, I got a response. In all of these cases with the exception of one, the response was positive.

The recruitment process lasted until 21.04.2022, which means that the process of securing all necessary interviews that would allow for answering the research questions, lasted almost three months. Although I had anticipated that the recruitment process would be demanding due to the characteristics of my study population (busy leaders with many responsibilities, and a group sought after by many students and researchers), the process still required more time and work than I had expected. Nevertheless, after time-consuming efforts, I managed to recruit respondents from relevant businesses throughout the whole value chain for vegetables in the Norwegian food system.

The table below shows how the perspectives of respondents are representing the different components in the value chain. As the table demonstrates, some respondents hold perspectives from various components, as the businesses they represent are involved in economic processes in several components. It is also central to once again point out that the component food industry refers to the processing of vegetables, including minimal processing such as washing, cutting, and packaging.

**Table 1***Representation of the various components in the value chain*

|                   | Farmer | Food industry | Wholesaler | Supermarket | Food service | Waste management |
|-------------------|--------|---------------|------------|-------------|--------------|------------------|
| <i>Respondent</i> | X      |               |            |             |              |                  |
| <i>Respondent</i> | X      | X             |            |             |              |                  |
| <i>Respondent</i> | X      | X             |            |             |              |                  |
| <i>Respondent</i> | X      | X             |            |             |              |                  |
| <i>Respondent</i> |        | X             | X          |             |              |                  |
| <i>Respondent</i> |        |               | X          |             |              |                  |
| <i>Respondent</i> |        | X             | X          | X           |              |                  |
| <i>Respondent</i> |        | X             | X          | X           |              |                  |
| <i>Respondent</i> |        | X             | X          | X           |              |                  |
| <i>Respondent</i> |        |               |            |             | X            |                  |
| <i>Respondent</i> |        |               |            |             | X            |                  |
| <i>Respondent</i> |        |               |            |             | X            |                  |
| <i>Respondent</i> |        |               |            |             |              | X                |
| <i>Respondent</i> |        |               |            |             |              | X                |
| <i>Respondent</i> |        |               |            |             |              | X                |

#### 4.4 Data collection

Based on the overarching aim of this study, I found it most fruitful to apply a semi-structured approach to the interviews. This is a flexible form of interviewing which ensures that certain topics are covered in the conversation while at the same time respondents are allowed to highlight what they find important and elaborate on their perspectives (Bryman, 2016). This leeway given to interviewees was important in order to let new and important perspectives and themes emerge, which could be further investigated with follow-up questions.

##### 4.4.1 Interview guide

An interview guide was created prior to the data collection. For all sampling groups, the guide was adjusted to fit the interviewees, in terms of formulation and possible follow-up questions. As the research strategy of this study is semi-structured qualitative interviews, the point of the interview guide was merely to guide the conversation, rather than being a strict scheme that had to be followed. The first part of the interview guide consisted of questions about the participants, such as their position and role in the business they work in. I also included a question on whether their business was concerned with sustainability. Such questions are useful for contextualizing the answers of interviewees (Bryman, 2016).



Next, the interview guide was structured in themes with associated questions, which were based on the theoretical concepts and framework described in chapter 3. Eight overarching themes were outlined: 1) understandings and initiatives connected to circular economy, 2) regulative factors, 3) economic factors, 4) socio-economic factors, 5) technological factors, 6) ecological/nature-based factors, 7) cooperation and collaboration and 8) power relations. However, in order to allow interviewees to identify the barriers and drivers they themselves perceived as most important without being guided by the specific themes, the interview guide included one open question on what they experienced to be barriers to CE for vegetables in the Norwegian food system in general, and one open question on drivers. Although the questions in the interview guide were based on the theoretical concept and framework applied in this research, I aimed for formulating questions with language that would be comprehensible and relevant to the interviewees, as suggested by Bryman (2016). The full interview guide can be found in the appendix.

#### **4.4.2 Conducting the interviews**

As Bryman (2016) states, it is important to give participants sufficient information about the study in order to allow for an informed decision on whether they would like to participate or not. Prior to conducting the interviews, the respondents received a consent form with information about what participation in this research project would involve<sup>1</sup>, which all respondents gave their consent prior to the data collection. In addition, all interviews started with an explanation of the study. The respondents were assured that they were not obliged to answer certain questions if they did not wish to and that they were welcome to ask questions throughout the interview if something seemed unclear or needed further explanation.

A total of 15 interviews were conducted. All interviews were conducted with individual respondents. The interviews were either conducted in person, by telephone or by video call over the digital platform Microsoft Teams. When choosing a digital platform, Teams was deemed the most appropriate choice as it does not require any download of software for those invited to meetings, which was of convenience to respondents. Also, using Microsoft Teams through my NMBU account ensured that data was stored within the guidelines of the University. The format for each interview was chosen based on the geographical distance and/or convenience of the

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<sup>1</sup> See section on ethical considerations (section 4.6) for a further explanation of what information was given in the consent form.

interviewee. All interviews were conducted in Norwegian, as the data collection was carried out in a Norwegian context where both the interviewees and I as the interviewer have Norwegian as our mother tongue. Furthermore, all interviews lasted between 30 and 90 minutes. The interviews lasting only 30-40 minutes were due to the short available time of the interviewees.

The interview guide was used in all interviews, but the interviewees' ability to answer the questions associated with the different themes varied a lot. The structure of the conversation was more guided by what themes seemed more natural to follow up with, rather than the written order in the interview guide. In some cases, certain themes would be skipped, either due to lack of time or because the interviewee had not reflected on the topic.

In most of the interviews, there were no issues in the process. However, in some of the interviews conducted over Microsoft Teams, there were some issues with the internet connection, which made it hard for one part to understand what was being said by the other. This was solved by changing the internet connection, repeating questions and answers, or by talking slowly. These measures ensured that no important information was lost in the interviews.

All interviews conducted on either Teams or in person were recorded and later transcribed. The transcribing happened as soon as possible after the interviews, in order to become aware of emerging themes that should be further investigated in later interviews (Bryman, 2016). In the interviews carried out over telephone, notes were taken during and after the interview. After each interview regardless of format, I wrote a summary of what seemed to be the most important points mentioned by the interviewee as well as my initial reflections on the collected data. This approach allowed for the analysis to be an ongoing activity from the first interview.

#### **4.5 Analysis approach**

The analysis approach in this study has been a thematic analysis, which is a qualitative analysis approach in which key themes are extracted from the data (Bryman, 2016). My analysis process followed the steps for conducting a thematic analysis suggested by Bryman (2016, p. 587-588): First, it was necessary to read through the material in order to become familiarized with it. This was done several times to allow for a thorough familiarization process. The next step was to

code the data, where I searched for recurring patterns in the material. Based on this, I formulated specific codes meant to capture the various subjects deriving from the data. In order to sort the material by codes, I used color-coding, as Berg & Lune (2012) suggest it as a useful strategy for sorting data material. The third step in the process was to turn the codes into themes, which is done by reducing codes into common elements. This was done through an iterative process where I revisited the predefined themes based on the theoretical concepts and frameworks when going through the material, in order to see if they corresponded or with the emerging themes. I found that the themes emerging from the coded data were often bearing elements from several of the predefined themes, and that they therefore had to be adjusted and supplemented by new themes. Quite simultaneously with this third step, I created a sort of hierarchy for the codes, which is the fourth step. This was done to evaluate which codes were of higher relevance to the research questions, which is often revealed when looking for common themes. In order to create an overview over the different themes and the material relating to them, I structured the material by themes in tables in Microsoft Excel. The fifth step was to look for possible connections between the identified themes. This was done by adding comment sections to each theme in the tables in Microsoft Excel, where I noted which other themes it might relate to. The sixth and final step was to do the write-up of the findings. These will be presented in chapter 5.

#### **4.6 Ethical considerations**

In order to protect respondents from any harm from participating in this study, as well as to ensure the integrity of the research, some ethical considerations have been made. In order to ensure that the research would be within ethical standards on data protection, a research summary, the interview guide and the consent form was submitted to the Norwegian Centre for Research Data (NSD) for approval. The research project was approved without further alterations. As mentioned earlier in this chapter, the consent form explaining the purpose of the research and what participation would entail was sent to all respondents prior to the interview. Through this, participants were informed that participation was voluntary, that their data would be stored in a secure manner, and that their data would be deleted when the project period ended. In the interviews conducted through video call or in person, I asked if participants agreed to the interview being recorded even if it had been mentioned in the consent form, to be certain that this information had come through. All respondents gave their informed consent to participate in the study.

In order to ensure the anonymity of respondents in this thesis, no information on their name, age, gender, or workplace has been revealed. Furthermore, as some of the components in the value chain for vegetables in Norway only consist of a few businesses, I decided not to reveal which component respondents represent when citing them in the analysis. This was to avoid any association being made on which business they might work in. Instead, all respondents have been given an arbitrary number between 1-15, as this is the number of interviews having been conducted.

#### **4.7 Limitations and trustworthiness**

In this section, a few concerns on the limitations and trustworthiness of this study will be provided. First of all, due to this research being a 30 ECTS master's thesis and set within the timeframe of one semester, it was necessary to make some delimitations in relation to the scope of this research. In order to create a feasible scope, I have only investigated barriers and drivers for a transition to CE for vegetables post-harvest, and thus have not paid much attention to factors relating to pre-harvest processes even though they are central to consider when assessing possible CE implementation in the agri-food system. Furthermore, the sample size is relatively small and additionally represents several components. This means that the perspectives are far from being generalizable to neither each component nor the whole value chain for vegetables. Nevertheless, the findings of this study can still contribute to a better understanding of tendencies in the system, or so-called demi-regularities as they would be referred to in the field of critical realism (Fletcher, 2017).

There are also some implications in relation to the method of the data collection. As mentioned earlier in this chapter, I structured the interview guide in a way that would allow respondents to point out what they perceived to be barriers and drivers before asking about specific areas where these might occur (regulation, economy, society and culture, biophysical environment, technology, power relations, collaboration and cooperation). However, some respondents wanted to know more about the questions that would be asked in the interview before agreeing to participate in the study. Thus, in a few cases, respondents were told in advance that these themes would be covered. This might have affected their answers to some degree, as they were able to reflect upon them before the interview was conducted.

Another barrier relating to the data collection, was that some interviews were too short to cover all themes in the interview guide. This concerns the interviews lasting only 30-40 minutes due to the short available time of some interviewees. This might have resulted in fewer barriers and drivers being identified than if the interviews had lasted long enough to cover all themes. Nevertheless, as many of the actors within my sampling frame did not have time to participate in this research or did not respond to my request at all, it was important to go through with the shorter interviews in order to secure perspectives from all components in the vegetable value chain. In the shorter interviews, I let the respondents focus on the themes they themselves identified and followed up with thematic questions which seemed the most relevant based on their initial responses.

Regarding the analysis of the transcribed material, some language-related implications might have affected the results. The interviews were conducted and transcribed in Norwegian, which means that the quotes in the analysis chapter have been translated. This sometimes affects the level of accuracy due to e.g., missing terms. I have tried to keep the translations as true to the original quotes as possible in order to ensure that essential meanings and context are not lost.

There are some limitations following the level of anonymization in this thesis. As I have not stated which component the various respondents represent in order to avoid association to which business they might work in, it has not been possible to analyze what respondents have to say about their own component and contrast it to the perspectives of those actors who are working in other components of the value chain. This is affecting the transferability of the research, as it makes it impossible to transfer the separate perspectives from each component group to other contexts. However, the findings suggest tendencies and contrasting perspectives in the value chain that can be valuable to investigate further, either in the same context or in other similar ones, such as other value chains in the Norwegian food system.

## **5.0 Analysis**

In this chapter, the analysis of the data will be presented. Initially, how respondents will be addressed in this chapter is explained. Next, the way respondents understand the concept of CE is described, as a backdrop for the further presentation of factors affecting the transition to a CE for vegetables in the Norwegian food system. Then, the findings will be presented in two parts relating to each of the research questions. The identified barriers and drivers are analyzed by themes and illustrated with quotes from respondents who have shared their perspectives on the given issue.

### **5.1 Addressing respondents**

As all respondents in this study have been anonymized, they will be referred to as ‘respondent’ together with an ascribed number ranging from 1 to 15. When a pronoun is needed to explain what a respondent has said, the person will be referred to in the neutral and genderless way ‘s/he’.

As stated in the methods chapter, some of the components of the value chain consist of only a few businesses. In order to ensure anonymity, it will therefore not be stated what component the respondent’s number is connected to. The barriers and drivers that are identified as specific to a certain component are not necessarily highlighted by the respondents working within that component - meaning that the identified factors affecting CE initiatives in the farmer component might be based on perspectives of respondents working within e.g., the wholesaler or food service component (and vice versa).

### **5.2 How is circular economy understood and used?**

The respondents have reflected upon the concept of CE to various degrees. Some are very uncertain about what it entails, and the concept is not in use in their business operations. Others explain that they do not explicitly refer to the concept in their business operations, but the principles of CE are embedded in their practices and goals. A few respondents use the concept of CE in their work and have a clear conception of the term.

However, as discussed in the background section, there is no widely accepted definition of the concept of CE. This allows for many ways of understanding the concept. Nevertheless, many of the respondents seem to have some common conception of CE, e.g., that reducing waste is pivotal. There are also several who point out the need for returning biological resources (vegetables) back into the biophysical sphere. Some also pointed out that it is about keeping resources at a high value. All these understandings are in line with the definitions applied in this thesis. However, one respondent's understanding was divergent from this definition, as s/he perceived CE not to necessarily relate to environmental sustainability (e.g., circulating hazardous materials). Some respondents also emphasized that the concept of CE can feel overcomplicated for some actors, as it has yet not been applied much when talking about the food system in the general public. With the intention of clarifying what I referred to when asking about circular approaches and factors affecting the transition to a CE for vegetables, the principles of CE as defined by the Ellen MacArthur Foundation (Ellen MacArthur Foundation, n.d.) were explained after respondents described their own understanding. The principles are 1) reducing waste and emissions, 2) cycling resources at the highest possible value, and 3) regenerating nature (by e.g., returning biological resources to the biosphere).

### **5.3 What are the barriers?**

The following section relates to the first research question, which reads as follows: *What are the barriers to a transition to a circular economy for vegetables in the Norwegian food system, as understood by leaders within businesses in this system?* It is important to point out that many of these barriers are interlinked and sometimes overlapping, depending on the perspective of analysis. The table below summarizes the identified barriers.

**Table 2***Identified barriers and main takeaways*

| <b>Barriers</b>   | <b>Main takeaways</b>   |
|---|---|
| <i>Hindering regulations</i>                                    | Strict regulations on the sale of expired food products.  |
|   | Strict regulations on the use of food waste for human or animal food production, as it also affects insect breeding.  |
|   | The Food Waste Act, which is up for consideration in Norway, if it does not consider all possible side-effects.   |
|   | The lack of food waste sorting in several municipalities.   |
| <i>Lack of political incentives and economic risk</i>           | Several respondents highlight that CE approaches require enormous investments.  |
|   | The lack of political incentives for industrial development, technologies, facilities, and a renewable energy transition.   |
|   | Uncertainties around what circular technologies and approaches are most profitable make this an economic risk.  |
|   | As vegetables are low-cost products, it is argued that it is often cheaper to let them go to waste than to apply CE approaches.   |
| <i>The size and standardization of economic processes</i>       | The strict standard requirements for class 1 vegetables, as vegetables are products with variety as part of their nature.   |
|   | Standardization is perceived to be necessary for an efficient product line regarding machinery in processing facilities, transportation volumes and packaging.  |
|   | Some class 2 vegetables are used in industrial processes, in the food service, or in low-cost product series. However, it is argued that there is still not enough demand for class 2 vegetables to avoid food waste. |
|   | In trades where fewer components of the value chain are included, there seems to be less food wastage.  |
| <i>Consumer preferences</i>                                     | It is argued that consumer preferences guide business choices, and that the preference for cheap, accessible, and good-looking vegetables is a barrier for CE approaches.   |
|   | Some respondents argue that if consumers had more of a choice, they would be happy to eat more irregular sized and shaped vegetables.   |
| <i>The conflict between vegetables and supporting resources</i> | Circularity in one area might affect circularity in other areas. This regards especially the conflict between plastic packaging and food waste.   |
| <i>Knowledge gaps and lack of awareness</i>                     | Lack of knowledge on how to change business processes without losing opportunities for growth.  |
|   | Knowledge gaps within the value chain on other actors' work processes, obstacles, and potential for creating value.   |



|  |   |
|--|---|
|  | Lack of knowledge and awareness among economic actors and consumers.  |
| <i>Lack of holistic thinking and collaboration</i> | A lack of holistic thinking and collaboration within components of the value chain. This concerns especially the farmer component and the food service component. |
|  | A lack of holistic thinking and collaboration across components of the value chain.   |
| <i>Lack of willingness to change</i>               | Farmers are perceived to be unwilling to change their processes. This might partly be due to requirements for profitability and efficiency.                       |
|  | Lack of willingness to change if CE initiatives will not certainly generate economic gains, or if these gains are not visible.                                    |
| <i>Power structures in the value chain</i>         | A perspective of concentrated power in the value chain.   |
|  | A perspective of power being divided throughout the value chain, and that there is a shared responsibility to push the transition.                                |

### Hindering regulations

There are some regulations that impedes circular initiatives. Several of these relate to strict regulations on the use of expired and wasted food. One regulation that is addressed by several respondents, is the regulation on sales of expired products, which is particularly a hindrance for supermarkets. In Norway, packaged products are either marked with ‘best before’ or ‘last day of use’. In the case of the former, products can be sold after the marked date, but the supermarket has the responsibility of ensuring that the quality is still acceptable. In the case of the latter, supermarkets are not allowed to sell the product after the expiration date (Mattilsynet, 2019). Several respondents emphasize that the marked date is often set long before the product is actually inedible, which results in unnecessary food waste. The respondents who address this regulation agree that food safety is important, however, they find the current regulation to be too strict.

Another regulation that is identified as a hinder, is one relevant to the waste management component of the value chain in relation to the use of food waste in insect breeding. Due to the ‘prion regulation’<sup>2</sup>, vegetable waste cannot be used for human or animal food production when it has been in contact with animal products, because prions, which might lead to illness, can be transmitted. However, respondent 12 claims that these prions are not transmitted in insect breeding, and states: *‘It is not a regulation based on experience, it’s an umbrella regulation which includes a lot to make sure that nothing is done wrong’*.

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<sup>2</sup> Prionregelverket

In Norway, there is also currently a discussion on whether a Food Waste Act should be implemented. Although the intention with such a law would be to reduce food waste, a couple of the respondents are skeptical of the effects such a law might have. For example, respondent 13 is afraid that it might be counterproductive, and argues: *‘The consequence is that the eye of the needle for quality for farmers just gets smaller. Actors [in the food chain] get scared of generating waste, so they rather reject a batch [of vegetables] of which they would have sold 90%, but will have to throw away 10%’*.

In addition, some respondents point to the waste regulations being a barrier to a transition to CE for vegetables in Norway. The current regulations have not required municipalities to establish waste systems where food waste can be sorted out, and thus many municipalities do not have such systems<sup>3</sup>. Respondent 14 argues that *‘a lot of food waste is lost due to many municipalities not sorting it. (...) it’s about time to sort everything’*. The current lack of systems for sorting as a consequence of current waste regulations thus results in certain fractions of food waste ending up at the bottom of the waste hierarchy, where it is incinerated with other residual wastes.

#### Lack of political incentives and economic risk

The lack of political incentives is highlighted by many respondents as a key barrier. They emphasize that many of the needed steps to accelerate towards a CE for vegetables require enormous investments - for example for product development or for building the necessary facilities and accessing the necessary technology. Many economic actors are not in a position to make such investments. As respondent 11 remarks, *‘it is not always possible to do it [investments] step by step either, so it requires some heavy lifting’*. The perceived lack of incentives aimed at driving these investments is also exemplified by respondent 14, who states: *‘political incentives for industrial development are needed’*. Another example is respondent 4 who addresses the political objective of reducing the use of fossil energy sources in the fruit and vegetable sector by saying: *‘We have no chance. If we are to make it happen, they [the state] must help us’*. Additionally, respondent 5 comments on the need to reduce the use of virgin plastics in the value chain and argues: *‘There are not many incentives for using recycled plastics either’*.

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<sup>3</sup> New regulations will come into force by 2023. Following the revised waste regulations in the EU, Norwegian municipalities, business actors and residents will be obliged to sort food waste from 2023 (Avfall Norge, 2017).

Several of the actors in the value chain of vegetables are in an economic position to do large investments with the aim of adapting to circular practices (and several of them do it, too). However, in many cases, there are still large uncertainties around what circular technologies and approaches are most profitable. A lot of testing and exploration is still needed, which makes it an economic risk to make investments although an actor has the capital to make it in the first place. It stated by several respondents that it is contradictory to the corporate nature to do investments without the assumption that it will create economic returns. For example, while talking about if food waste (e.g., surplus, good quality with a few damages, outside standard requirements), could be used in industrial products, respondent 5 says *'if you are serious about making products through processing, it is a barrier that it is a big investment'*. Also here, respondent 5 mentions that there is an absence of political incentives: *'there is little funding, as far as I know, for such investments, from the state I mean, and there are no favorable loans either'*.

Furthermore, the characteristics of vegetables as a commodity exacerbates the economic risks of exploring alternative value streams for vegetables that are lost or wasted. Respondent 1 exemplifies this: *'the challenge with fruit and vegetables is that they are low-cost products. So-called differentiated products, class 2 - the minute a farmer touches these vegetables, the costs start to run. With labor, packaging, transportation, you get such a large fraction of the costs before it [the product] reaches the supermarket, so it's a problem. It is therefore often cheaper to just plough the vegetables back to the ground, or use them for animal feed – they are not able to get that price in the market because the costs of managing it are too high'*. This illustrates that the characteristics of vegetables and the uncertainty of what are successful circular approaches can constitute a double barrier for taking the risk of economic investments, which again strengthens the need for political incentives.

#### The size and standardization of economic processes

The majority of respondents emphasize that the strict standard requirements for class 1 vegetables is a barrier, as it leads to food being wasted. However, some respondents argue that large-scale value chains of vegetables are dependent on some standardization in their processes in order to have an efficient production line. Respondent 11 explains that *'when you build a factory, you need to have standard requirements. You have some expectations to what you'll get in, in order to get what you want out'*. Several respondents argue that standard requirements

are needed for size and shape due to the machinery in the processing facilities, and size and shape matter for transportation volumes. Similarities in size and shape are also important for packaging reasons. As respondent 2 argues, *'it makes sense in a value chain for fruit and vegetables to sell a 500g cup, because it's easier in transportation, it's easier in relation to loss, it's easier in all sorts of weird ways'*. From this it can be interpreted that adapting more specialized processes with room for variety would require more resources, both in terms of workforce, time, facilities, and ultimately costs.

The standardization of economic processes is bound to create waste when the product holds variations as part of its nature. Respondent 11 argues: *'as long as you try to automate something, there will be challenges. (...) you think that a potato is a potato, but it's not always so'*. As much as three respondents emphasize that vegetables cannot be equated with screws - it is important to take into consideration that vegetables are products cultivated in nature, not manufactured into a certain shape in a factory. Certain biophysical barriers still pertain, such as variable seasons and crops, diseases, malformations, and damages. Thus, having strict standard requirements for which vegetables are allowed to pass through the value chain, ultimately results in large fractions of vegetables having to be thrown away.

However, several respondents highlight that some class 2 vegetables are used in industrial processes, in low-cost product series, or in the food service. Nevertheless, a few remarks made by other respondents counter these arguments. For industrial processes, there are standard requirements even though they might be a bit looser, resulting in many edible vegetables still not being included. Moreover, when talking about the low-cost product series various supermarket chains have, where vegetables with more varieties are included, respondent 6 argues: *'the problem is that there is very little demand for that [low-cost] bag. Then it doesn't help much that the standard requirements are a bit looser for that product'*. In relation to the use of class 2 in the food service, several respondents argue that it is not as important what shape and size the vegetables have, because they are often chopped, mashed, and prepared for serving, and appearance is thus not so important. However, it is emphasized that actors working in the food service are often not given a choice on whether they want to order 'less perfect' vegetables. Additionally, those who are given this option don't always do it as they also want to present good-looking vegetables to the end consumer. In sum, a lot of class 2 vegetables never get a place in the value chain for vegetables in the Norwegian food system.

Some respondents highlight that in trades where fewer components of the value chain are included, less waste seems to be generated. Two respondents emphasize that in the case where farmers are doing the processing and packaging themselves, they are to a larger degree able to control which vegetables can be sold, either through packing various sized vegetables within a weight requirement from other actors in the value chain, or by processing irregular sized vegetables to ‘chunk packages’. Also, two respondents argue that when farmers sell vegetables directly to consumers through farmers' markets or farm shops, they are able to sell irregular-sized, shaped, and colored vegetables. In this way, they leapfrog some general standard requirements.

### Consumer preferences

Several respondents underline how their business choices and approaches are guided by what the consumer wants. For example, respondent 11 points out that *‘the consumer is the one who decides, and [he/she] has clear opinions on how things should look and smell’*. This suggests that including more class 2 vegetables in the value chain, developing and promoting products based on food loss, and investing in technology that contributes to a more circular food system, are of no use if the end consumer is not interested in buying these products or paying the extra costs of implementing these technologies.

Central to consumer preferences is how food is understood and valued in Norway. Respondent 1 argues that *‘there are some entrenched attitudes that fruit and vegetables should be cheap’*. This points to the fact that if a food product is wasted, it does not affect the average Norwegian consumer’s personal economy much to replace it, which might lead to low valuation of vegetables as a product.

Additionally, food is highly accessible in Norway. Respondent 13 argues that *‘Norway is one of the countries with the most supermarkets per head’*. Especially in urban areas, Norwegians can access multiple supermarkets within short walking distances. Also in the vein of accessibility, is the tendency that Norwegians have gotten used to accessing a wide variety of products all year long. Respondent 4 argues that *‘seasons have been erased. It’s probably part of the picture, everything is available at all times’*. Vegetables which can be produced in Norway are not only available during their Norwegian season, but at all times. Furthermore, the Norwegian diet encompasses a large variety of products that could never have been cultivated in Norway (e.g., the Norwegian avocado addiction), which are also accessible all year round.

Several respondents perceive that there is a certain ‘spoiled-culture’ in the Norwegian consumption of vegetables, which represents a misconception of the general accessibility of vegetables and the costs of vegetable production.

However, the respondents hold various perceptions of what consumers actually want in regard to vegetables. While several respondents argue that consumers want good-looking vegetables because they eat with their eyes, and because they are used to this so-called ‘spoiled-culture’, others argue that if consumers had the choice, they would be happy to eat more crooked carrots and variable-sized turnips - the problem is that such vegetables are often not available in supermarkets.

#### The conflict between vegetables and supporting resources

It can be argued that creating a CE for vegetables in the Norwegian food system depends on a circular application of all resources used in the various processes. In other words, it is not a circular system if the cost of ensuring that no vegetables go to waste means that there will be increased amounts of supporting resources wasted. However, as respondent 11 argues: *‘one is always required to make some choices and priorities. This means that circularity in one area might affect circularity in another area’*. A barrier to creating a fully circular system is thus to achieve circularity for both vegetables and the supporting resources.

The conflict between resources which is most often addressed by respondents, is the difficult relationship between plastic packaging and food waste. None of the respondents are proponents of banning plastic packaging altogether, as they see it as necessary to prolong the durability of certain vegetables. Respondent 10 argues that *“there seems to be an established truth that plastic is bad, cardboard is good, and no packaging is best. (...) It’s not plastic which is the problem - it’s plastic going astray which is the problem”*. In the same vein, respondent 13 claims that *‘all bans of plastic packaging will lead to food waste’*. At the same time, several respondents question if all current plastic packaging is done for durability reasons, and whether it is necessary. Respondent 10 exemplifies this by saying: *‘there is no use in wrapping plastics within plastics - that should be avoided’*. Respondent 5 also questions if it is necessary with double-digit variants of plastics and says: *‘I’m guessing there are 16-17-18 types of plastics in supermarkets now. It doesn’t make it easier to recycle’*. This points to the fact that there is much room for improvement in the field of plastic packaging. However, this is again linked to

standardized economic processes in the value chain and the economic risk of investments into new, possible solutions, and these issues must therefore be assessed in relation to each other.

#### Knowledge gaps and lack of awareness

Knowledge gaps are frequently mentioned barriers by respondents. For example, respondent 15 points out there is a lack of knowledge on *'(...) how to change business processes without losing opportunities for growth'*. This suggests that actors in the food system might have knowledge gaps on what could be profitable circular approaches for their own businesses.

On the question of whether there are knowledge gaps within the value chain, several respondents answer with a certain yes. There are also several in various components who admit to not knowing enough themselves. This concerns both knowledge of the work processes of other actors in the value chain (in their own component and in other components), what obstacles other actors are facing, and where there is potential for creating value. For example, respondent 13 says *'we see that supermarkets have too little knowledge on how food production works in practice, so it would probably help if they gained a greater understanding of this'*.

Some respondents also claim that there are knowledge gaps and a lack of awareness within actor groups affecting the processes in the value chain. A few respondents argue that there are political actors who lack knowledge of the needs of economic actors, how the economic process in the value chain of vegetables works, and what are the challenges economic actors are facing. For example, respondent 4 states that *'there is much lack of knowledge among those who rule this country'*. This might result in political decisions which are not apt to meet the needs of economic actors. Additionally, several respondents argue that consumers lack knowledge of how vegetable production and the value chain work, what are the problems, and how they can contribute through their choices. For example, respondent 4 claims that *'for vegetables, I think they [consumers] know very little about how it [the production] works'*, and further argues that more knowledge would enable consumers to make more informed choices.

#### Lack of holistic thinking and collaboration

According to most respondents, there seems to be a lack of holistic thinking for solutions - several respondents claim that many actors are mostly preoccupied with their own business operations and do not think about the system as a whole. This concerns both collaboration and holistic thinking between actors within the same component in the value chain, and between

actors in various components of the value chain. Respondent 2 exemplifies this when saying: *'I experience that we very often work in silos where everyone has some kind of hat on'*.

Regarding the lack of collaboration between actors in the same component of the value chain, this seems to be especially the case within the farmer component and the food service component. When talking about collaboration between farmers, respondent 6 claims that they *'are probably a bit too fractioned on the farmer side, especially in relation to those question [circular approaches]'*. They further explain that although many farmers are organized, the organization is not good enough and the farmers therefore don't have much power to influence further out in the value chain. In a similar vein, respondent 3 argues that if food service businesses had *'joined forces'*, they *'could make things happen'*. These perspectives indicate that collaboration in the value chain components, which are made up of many small actors, might also be a way to relocate some of the power in the food system.

Furthermore, there seems to be a perceived lack of collaboration between actors in various components for finding solutions across the value chain as well. This is for example manifested through the lack of cooperation for creating value upstream on by-products and food waste. Respondent 2 says: *'I don't think there are good enough arrangements for ensuring that those products [surplus food in storages] would be taken into a by-product production. (...). It is not designed for that, for ensuring someone comes to pick up those carrots and process it into something else'*. Similarly, when discussing the same topic, respondent 6 says *'I think there is room for improvement on coordinating all this'*. Nevertheless, there are some actors in the food system creating value on vegetables that would otherwise be lost. However, respondent 6 highlights a current barrier in relation to that: *'There is still such a limited volume that - it avails a bit, but it does not avail enough on what we can call class 2'*.

### Lack of willingness to change

Based on the perspectives of respondents in this study, there seems to be a lack of willingness to change which is manifested in various ways in the value chain for vegetables. Several respondents from various components in the value chain claim that farmers tend to cling to traditional ways of doing things. Respondent 5 argues: *'It is extremely important that we have forward leaning agriculture and see the possibilities as well as wanting to take part in developing this. And that is something I miss sometimes'*. Similarly, respondent 15 says that farmers *'need to be interested in changing their way of thinking'*. Furthermore, respondent 11



claims that *'Norway is to a much less degree based on fact-based knowledge than other countries, and more on "farmers' practical sense"<sup>4</sup>*', which s/he sees as a barrier.

However, respondent 2 argues that the farmers' lack of change is not only due to a lack of willingness to change: *'There are requirements for profitability, for efficiency across [the value chain], which makes farmers a bit tied to produce the way they have always produced'*. Furthermore, respondent 4 argues that although it can be true to some extent that farmers lack a willingness to change, they are bound to change when the system is changing. S/he argues that if a farmer doesn't change when other farmers do so, *'they're done. (...) they have to follow along on new things'*. It can thus be interpreted that if the change is required, as well as facilitated, farmers might be more likely to change their practices to align more with CE initiatives.

Another perspective relating to the lack of willingness to change, is that when CE initiatives are expected to have low or uncertain economic returns, they are less likely to be carried out regardless of the potential of generating environmental value. This is thus connected to the barrier of economic risk. As respondent 15 argues, initiatives *'have to give a profitable effect too. And it is not deniable that the concept of a circular economy has not always been seen as a profitable way to go'*. Similarly, respondent 7 argues: *'Every serious business that would go out and say that the environment is more important than money, would be lying. Of course, a sustainability model is important, but I do not think there is any way in the future to run a sustainable business without it being both financially sound and environmentally sound.'* Respondent 9 holds the perspective that in the case where CE initiatives are expected to be profitable, practices might not be changed regardless: *'the costs for investments are more visible than the gains of reducing food waste'*. These findings indicate that in order to make the necessary CE initiatives a reality, it is a prerequisite that they will certainly generate economic gains, and that these gains have to be visible to economic actors.

#### Power structures in the value chain

When asked which actors have power in the food system, and more specifically the power to change the system, a clear majority of respondents answer the same: the power lies with the supermarket chains. Several respondents see this as a barrier, as it restricts many actors' ability

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<sup>4</sup> This is a translation of the norwegian expression 'sunt bondevett', which refers to a practical sense perceived as characteristic of Norwegian farmers.

to make their own decisions. Respondent 6 argues that *'there is no doubt where the power lies, like generally, it's with the supermarkets. (...) if those actors can't or won't [change] enough, we can just stand here yelling'*. Similarly, respondent 4 explains that *'they [the supermarket chains] have extreme amounts of power on price, on how the product should look, etc. They are extremely tough'*. This suggests that smaller actors who are bound to follow the requirements of powerful actors have little leeway to change their practices. Therefore, this might be a barrier to adopting more circular practices, unless this is especially pushed for by the actors with power.

In contrast, a couple of respondents argue that the power is more divided throughout the value chain. In the extension of this, they see it as a shared responsibility between various actors to push the transition toward a CE for vegetables. Furthermore, respondent 15 emphasizes: *'and of course, the right policy framework needs to be in place'*, which can be interpreted as political actors also possessing power in this case.

#### **5.4 What are the drivers?**

This part of the analysis relates to the second research question, which is formulated in the following way: *What are the drivers to a transition to a circular economy for vegetables in the Norwegian food system, as understood by leaders within businesses in this system?* The drivers include already existing initiatives that respondents have emphasized as positive, as well as factors they believe could be possible solutions to many of the barriers discussed in the previous part of this chapter. The table below summarizes the main identified drivers.

**Table 3**  
*Identified drivers and main takeaways*

| <b>Drivers</b>  | <b>Main takeaways</b>   |
|---|---|
| <i>Increased knowledge and awareness</i>                    | Increased knowledge and awareness among consumers.  |
|   | Increased knowledge and awareness-raising throughout the value chain. This regards knowledge about the processes, challenges, and opportunities in one's own component as well as in other components of the value chain. |
|   | Awareness-raising is seen to be a shared responsibility between political and economic actors.  |
|   | A generational change is perceived to be happening regarding values and preoccupations relating to sustainability and circularity.  |
| <i>Circular approaches are becoming profitable</i>          | The interest in CE approaches comes when it is clear that they will generate profits.   |
|   | Sustainability can become a competitive advantage to the vegetable sector.  |
| <i>Political responsibility, incentives, and guidelines</i> | Political responsibility for setting common goals and directions for economic actors.   |
|   | Political responsibility for ensuring quality in the data and approaches which are used for measuring the transition.   |
|   | Political incentives and funding.   |
|   | Political regulations and requirements, if all possible side effect are considered.   |
| <i>Collaboration and holistic thinking</i>                  | Collaboration within and across the various components of the value chain.  |
|   | A holistic approach where the whole system is considered should be applied when developing solutions.   |
|   | The respondents who already engage in collaborations within the value chain experience that this facilitates circular approaches.   |
|   | Collaboration between political and economic actors can result in more appropriate measures.  |
| <i>New technologies</i>                                     | Emerging technologies for pre-harvest processes affect post-harvest processes.  |
|   | Technologies for collecting and analyzing data.   |
| <i>Strategic division of power</i>                          | Concentrated power in the value chain, if used right.   |
|   | Dividing the power throughout the value chain. Cooperatives can be used to achieve this.  |

As an initial remark, there seems to be a consensus amongst most respondents that the food system is already changing, and that a lot of positive initiatives already exist in relation to e.g., technology, product development, setting targets, and collaboration. However, respondents perceive that efforts in the beneath mentioned areas might help accelerate the transition to a CE for vegetables.

### Increased knowledge and awareness

Increased knowledge and awareness in the value chain and among consumers is regarded as a crucial driver by several respondents. Respondent 1 argues: *'It's all about knowledge. And in all components, really. And awareness-raising. That is what is crucial to create change'*. Relating to the knowledge of consumers, respondent 10 argues that *'consumers need to be enlightened on the perks of choosing this product [class 2 vegetables] (...) that in total, in an environmental perspective, you choose an alternative that reduces the food waste while you still have a good, edible product'*.

When asked about what actors are responsible for driving this awareness-raising, some are not certain, while several respondents point to it being a shared responsibility between political actors and the businesses in the value chain. Respondent 2 argues that in order to raise knowledge levels and awareness, *'I think the authorities need to be on board with the businesses to pull the load together'*. Respondent 10 argues in the same vein but puts some more emphasis on the responsibility of certain businesses in the value chain: *'You have for example the Norwegian Fruit and Vegetable Marketing Board<sup>5</sup>, but I think you need to have the supermarkets with you on the team, and maybe some other actors. (...) It is probably the supermarkets that need to take the initiative, and then the Norwegian Fruit and Vegetable Marketing Board can back it up. If the supermarkets are not a part of it, it won't be easy'*. These perspectives point to collaborative efforts being needed to raise knowledge levels and awareness.

Several respondents argue that there is a generational change in values and preoccupations happening in Norway relating to sustainability and circularity. An example is respondent 12, who holds the following view: *'I think the generation which is entering work life now are much more preoccupied with things having meaning, something bigger. People are awakening a bit,*

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<sup>5</sup> Called 'Opplysningskontoret for frukt og grønt' in Norwegian. A public foundation working to stimulate the production and consumption of fresh fruits, berries, vegetables and potatoes in Norway.

*they are more concerned with what is happening in our society*'. Many of the respondents believe this might naturally lead to approaches that are more aligned with a CE for vegetables. For example, respondent 5 argues that *'the competence on sustainability will increase immensely the next 15 years, right. Both because new consumers are entering the market, but also because we know more, you get it in from early childhood. That will change things'*. These perspectives support the claim that the system is already changing.

#### Circular approaches are becoming profitable

One major identified driver is the fact that it is becoming recognized that circular approaches can be profitable for economic actors. Respondent 2 claims: *'The key is that one acknowledges the profitability in sustainability, and makes it happen in an effective manner'*, and *'at the moment one realizes that there is money to gain, the interest comes'*. S/he further argues that some businesses that have created new products on food waste are highly profitable. Respondent 13 even argues that sustainability can be a competitive advantage in the vegetable sector. Similarly, when talking about using resources at the highest possible value, respondent 15 argues: *'It is what's most profitable for everyone, both the producer and the supermarket'*. Similarly, respondent 9 declares that *'it is not contradictory to be sustainable and to be economic'*. These arguments point to the increased awareness of opportunities for economic value creation in transitioning to a CE for vegetables, which might help facilitate CE practices.

#### Political responsibility, incentives, and guidelines

Several respondents highlight that the authorities have a responsibility for setting common goals and directions for economic actors and that this will be an important driver for the further transition to a CE for vegetables. For example, respondent 2 believes that the authorities need to set requirements for actors in the food system to ensure that every stakeholder works toward systemic solutions. S/he argues: *'the requirements have not yet been strict enough to ensure that everybody really does their part. (...) I'm optimistic that this will come'*. It is also argued that the authorities have a responsibility for ensuring quality in the data and approaches which are used for measuring the transition. Respondent 6 argues that *'this way we will get a good foundation for discussing and interpreting improvements'*.

The lack of public funding for CE initiatives was identified as a barrier. In direct relation to this, an increase in political incentives and funding is highlighted as an important driver by several respondents. Respondent 5 says: *'It is mainly politics. If the incentives are there to*

*change the process, the process will be changed. It's that simple'*. In a similar vein, respondent 12 argues: *'laws and rules can be important for giving incentives to make sustainable processes profitable, for example through taxes on what is bad, and incentives on what is good'*. Some of the areas where respondents argue that an increase in political incentives will be important for reducing the risk of necessary investments are testing alternative packaging, developing food waste-based products, constructing industrial facilities, changing to clean energy technologies, and creating public campaigns for awareness-raising.

Furthermore, some respondents point out that when assessing if political regulations can guide the development toward a more circular system, it is important to consider all possible side-effects of well-intentioned regulations. For example, the potential Food Waste Act is not only highlighted as a potential barrier - several respondents see it as a possible driver as well. However, respondent 5 emphasizes that: *'in principle, I'm a proponent for such a law, as long as it makes sense'*. Similarly, respondent 9 says that a Food Waste Act would be good if it is feasible to follow its requirements. These claims suggest that if the Food Waste Act is to end up as a driver rather than a barrier, all possible side effects need to be considered before it is applied. Another example is highlighted by respondent 6, who points to the importance of not constructing too strict regulations for food waste in the farmer component of the value chain. S/he argues that it is necessary to give leeway for natural variations in vegetable production, as these cannot always be avoided.

#### Collaboration and holistic thinking

In direct response to the identified barrier of lack of collaboration, the majority of respondents point to collaborating within and across the components of the value chain, and more holistic approaches to solutions, as significant drivers for the transition to a CE for vegetables. Respondent 2 argues: *'I think the revolution within this comes at the moment people understand the potential in the value chain'*. Furthermore, s/he claims: *'the magic happens when all three [producer, middleman, end-customer] succeed at collaborating'*. Furthermore, respondent 12 argues that there could be potential in creating collaborations across different sectors and value chains: *'we need to think that what is considered as waste in one place could be a value somewhere else. That means thinking across industries. Maybe food waste could be used in paint, or something'*.

Respondents who claim that their businesses are already good at collaborating, experience that this is contributing to circular approaches in the food system. Respondent 7 points to the potential of avoiding surplus orders through close collaboration with farmers. S/he also argues that collaborating with alternative downstream customers has reduced the food loss in their own operations. Both respondent 1 and respondent 11 make the same claim, who have also reduced the food waste in their operations through collaborations with actors who are interested in less aesthetic vegetables or vegetables close to their expiration date.

Collaboration between economic actors and political actors is also seen as a pivotal driver by several respondents. Many respondents point to the Voluntary Industry Agreement on food waste reduction, and how it has led to more actors in the food system being serious about reducing their food waste. However, several respondents believe that some collaborations should be more committing. Respondent 9 exemplifies this: *'I would argue that the best option is if state or municipalities collaborate with leading [economic] actors to create solutions together, which might become legally required later'*. Similarly, respondent 15 argues for regulated collaboration. S/he says that many collaboration fora *'are focused on increasing knowledge levels but might not be very committing. So I think more regulated collaborations would be very good'*. Respondent 2 is also certain that this would help the transition: *'the moment the business sector unites with the authorities and decides that they want change, things happen'*.

### New technologies

Various emerging technologies are pointed to as drivers for the transition to CE in the vegetable value chain. For example, respondents explain that there are many emerging technologies aimed at combatting some biophysical challenges to vegetable production, such as diseases, weeds, and droughts. Although these technologies are applied to the vegetable pre-harvest, they have significance for the vegetable post-harvest as well. Respondent 6 argues that farmers should do *'everything they can to become even better at producing as much class 1 as possible, being a good agronomist combined with new technology. It's an important step in reducing food loss'*. Similarly, respondent 13 argues that technology for optimizing production is important for reducing food loss in the farmer component of the value chain: *'I think that with better technology out on the field we can get better prognoses. (...) If we get better at saying something about how much will come and when it will come, with more technology that gives us information on maturity, and optimized time of harvest, it will increase the effectiveness, which*

*is an advantage to the circular economy*'. It can therefore be argued that technology pre-harvest can be important for achieving more circularity post-harvest.

Collecting and analyzing data for optimizing various processes throughout the value chain is also identified as a major technological driver for a transition to a CE for vegetables. For example, respondent 7 highlights the possibility of gathering historical data to calculate what consumers will want to buy several months ahead. This can be communicated to farmers, so they can plan their own processes and sales. Similarly, several respondents point to the potential of using technology for better waste management. For example, respondent 12 highlights how digital data collection technologies can increase value creation in waste management through acquiring information about the waste being disposed of, and thereby *'create new fractions of what is often wasted, which can be used for specific things, such as coffee grounds for mushroom farming'*. However, in relation to the identified barrier of hindering regulations, several respondents emphasize the importance of continuously adjusting political regulations in accordance with technological developments, so that they can be implemented and benefited from as soon as possible.

#### Strategic division of power

Although the concentrated power in the Norwegian food system has been discussed as a barrier, some respondents point to how the powerful actors have succeeded with several circular initiatives affecting the economic processes of several components in the value chain, and that this has been possible due to their position. For example, respondent 2 says: *'There can be good things with having control across the value chain, as long as the supermarket chains are aware of their own responsibility.'* This claim suggests that if used right, concentrated power can help guide the transition to a CE for vegetables.

In contrast, some actors are certain that they themselves, and others working within their component of the value chain, would be able to do more for a transition to a CE for vegetables if the power was better divided throughout the value chain. It is pointed out by several respondents that the power of some components can increase through using cooperatives in order to create common goals and directions, which points back to the driver of collaboration. This regards especially the farmer component and the food service component, which consist of many different and often small businesses. Some cooperative bodies already exist for promoting the economic and political interests of these components, but the respondents argue



that they could be used more for promoting and cooperating on environmentally sustainable activities. Respondent 6 argues that through cooperatives, *'the power can be shifted to some degree in the value chain'*, which s/he see as positive for making sure CE approaches can be implemented.

## **6.0 Discussion**

The aim of this study is to assess the drivers and barriers to a transition to a CE for vegetables in the Norwegian food system, as perceived by leaders in businesses working in the system. In this chapter, the findings presented in the analysis chapter will be discussed in relation to the reviewed literature in chapter 2 and interpreted through the theoretical concepts and framework presented in chapter 3. The chapter will be structured in line with the two research questions that have been guiding this research. First, a remark will be made on the level of precision in the analysis and discussion. Then, a discussion around the first research question regarding barriers will take place, which will be followed by a discussion on the second research question regarding the drivers. Lastly, some further reflections will be provided.

### **6.1 Identified factors**

The respondents identified a wide range of factors affecting the transition to a CE for vegetables in the Norwegian food system. Some of the identified factors are clearly linked to specific actors and institutions, while other factors are more overarching and dependent on the interactions between different actors. This concerns both the interactions between the economic actors which are part of the value chain for vegetables, as well as interactions between political and economic actors. However, most of the factors identified by the respondents are quite general. Especially in relation to driving factors, the respondents have mostly remained quite vague in what the actual drivers they point out would imply - most of the respondents focused more on who holds the responsibility for enabling such drivers but were not always able or comfortable to sketch out their possible contents. The tendency that many respondents perceive change to be needed, but don't necessarily know what the change should entail, might indicate that there is still a lot of work needed for finding concrete solutions. However, there have been a few cases where respondents have pointed to concrete factors, but which are very specific to their businesses. In order to ensure anonymity, these factors are referred to neither in the analysis nor in this discussion. Due to these aspects, the discussion remains rather general, but points to areas where there is a need for further assessment of possible measures.

## **6.2 Barriers to a transition to a circular economy for vegetables**

This section will discuss the main findings from the analysis chapter relating to the first research question, which reads as follows: *What are the barriers to a transition to a circular economy for vegetables in the Norwegian food system, as understood by leaders within businesses in this system?* The identified barriers will be discussed in relation to the existing literature reviewed in chapter 2 and explained through the applied concepts and frameworks defined in chapter 3.

In the analysis, it was suggested that informants perceive central barriers to the transition to a CE for vegetables in the Norwegian food system to be: hindering regulations; lack of political incentives and economic risk; the size and standardization of economic processes; consumer preferences; the conflict between vegetables and supporting resources; knowledge gaps and lack of awareness; lack of holistic thinking and collaboration; lack of willingness to change; and power structures in the value chain. As pointed out in the analysis, many of these barriers are interlinked and overlapping, which results in some repetitions being made.

### Hindering regulations

Hindering regulations have not specifically been addressed in the reviewed literature. However, in relation to drivers, De Jesus & Mendonça (2018) pointed out that policymakers have a crucial role in framing institutions that will facilitate CE approaches, which can also be interpreted as when institutions are not framed in favor of CE, they might be hinders instead. It can also be the case that hindering regulations become more apparent in micro level analyses when investigating specific products or organizations. Hindering regulations emerged as a theme because it was possible for respondents to point to specific laws and regulations hindering a reduction of vegetables being wasted or hindering the use of vegetable waste high up in the food waste hierarchy, such as the prion regulation and the waste regulation. This points to the importance of investigating micro systems in order to identify necessary changes in the institutions guiding the specific economic activities. Based on the perspectives of respondents in this study, there seems to be a need for evaluating resource regimes regarding economic actors' access to the use of resources in order to allow for the implementation of CE initiatives.

### Lack of political incentives and economic risk

The barrier of lack of political incentives and economic risk corresponds with the findings in several other studies reviewed in the background chapter, both on barriers to a transition to CE

in general and in relation to agri-food systems more specifically. Furthermore, the barrier has also been identified in the Norwegian food system (Stensgård et al., 2019) Lack of political incentives and economic risk thus seems to be a key barrier to implementing CE initiatives regardless of whether it concerns a transition at the micro, meso, or macro level, as well as to be of relevance to many different sectors and geographical contexts. The findings of this study demonstrate that lack of political incentives and economic risk in the vegetable value chain are relevant for e.g., industrial development and product development. The latter concerns both vegetables and supporting resources such as packaging. These findings point to a perception of public authorities not taking on their responsibility as both political actors (of creating political incentives through resource regimes) and as economic actors (of establishing financial aids for facilitating investments).

#### The size and standardization of economic processes

The barrier of size and standardization in the value chain for vegetables is a quite case-specific barrier as it points to specific features of the micro system (the vegetable value chain). As the findings of this study indicate, standardization is one of the reasons for strict standard requirements for vegetables. In the literature, the barrier of strict standard requirements was identified in the Norwegian food system, but it was seen as a response to customer demands, not as a means to facilitate industrial processes and transportation (Stensgård et al., 2019). The way the barrier of size and standardization is understood by some respondents in this study can however be connected to the identified barrier in the existing literature on the lack of necessary infrastructure and facilities in agri-food systems (Mehmood et al., 2021). Finding ways to use vegetables that do not pass these standard requirements, might require new or adapted infrastructure and facilities, which could be the responsibility of both political and economic actors. This could for example be new facilities created to make products based on class 2 vegetables. Regarding the size of the system, respondents have highlighted that more class 2 vegetables can be used when using shorter or alternative value chains. This is for example the case when farmers sell directly to consumers or when farmers sell to food service actors, where they leapfrog the standard requirements set by the food industry or the supermarket chains. These findings point to the possibility of reducing food loss and waste through alternative forms of trade interactions throughout the value chain instead of following one standardized value stream for vegetables.

#### Consumer preferences

The barrier of consumer preferences was also emphasized in the literature on the Norwegian food system (Stensgård et al., 2019). The respondents in this study point to consumers wanting good-looking vegetables, and thus that less aesthetic vegetables would not be bought. Respondents also claim that Norwegian consumers are used to vegetables being cheap and available at all times, as well as having a wide variety of choices on vegetables regardless of seasons. There are however differing perspectives on whether this is due to actual preferences or if these are shaped by what is made available by economic actors in the value chain. Regardless of the underlying reasons, it seems to have become a strong norm for Norwegian consumers to choose the best of the best. Changing norms is not an easy task. However, governance structures are important for shaping preferences through social processes, and if actors with normative power to influence consumer choices are identified (which could be both consumers themselves, political actors, businesses, or civil society actors such as the media), these actors can be made aware of their responsibilities, and strategic measures for affecting consumer choices can be put in place. This is also pivotal for the barrier identified in the literature of Norwegian consumers choosing other supermarkets if the assortment and exposure do not live up to their preferences (Stensgård et al., 2019).

#### The conflict between vegetables and supporting resources

The conflict between vegetables and supporting resources has not been highlighted in the reviewed literature. This might be because food waste has been assessed separately from what has been named supporting resources in this thesis. However, De Jesus & Mendonça (2018) noted that when political actors are framing institutions, contrary incentives must be avoided, which is relevant in this case. From a systems perspective, it is important to assess how CE approaches are not implemented at the cost of CE in other areas. As one respondent emphasized in this study, s/he holds the perspective that banning plastic packaging will ultimately lead to increased food waste. If it is assumed that this is the case, actors with power over resource regimes should not remove the right to access plastic packaging for economic actors, but rather evaluate the management and disposal of this resource.

#### Knowledge gaps and lack of awareness

The barrier of knowledge gaps and lack of awareness have also been mentioned in the literature on both CE in general and CE for agri-food systems. The findings in this study point to knowledge gaps being a reality within components of the value chain for vegetables, across components of the value chain, among political actors, and among consumers. It can be argued

that increasing knowledge thus seems to be an important starting point for succeeding with CE initiatives. It is necessary to know about a problem in order to find a solution for it, and it is necessary to know about a solution in order to implement it. However, as highlighted in the background, PACE (2021) emphasizes that in order to turn knowledge into action, it is necessary to consider the context of the people one is trying to influence through spreading information.

#### Lack of holistic thinking and collaboration

In the reviewed literature, collaboration and holistic thinking are highlighted as important for succeeding with CE initiatives. It is explicitly stated in the literature regarding the Norwegian food system that collaboration is needed between all components of the value chain (Stensgård et al., 2019). The findings of this study complement this, but furthermore suggest that there is a need for collaboration also within components of the value chain for vegetables as well. It is moreover highlighted that there is a need for collaboration between economic and political actors. An issue for succeeding with collaboration is the complex challenge of coordination. However, The Voluntary Industry Agreement on food waste reduction seem to have been an important first step for collaborative initiatives to reduce food waste, but as it is pointed out by Szulecka & Strøm-Andersen (2022), it might be necessary for political actors to get more involved in order to aid with coordination issues. The more cooperative form of interaction would then be complemented with elements of demand, e.g., through a possible Food Waste Act.

#### Lack of willingness to change

In the analysis of this study, it was found that several respondents perceive farmers as unwilling to change their practices. This is also a barrier which is highly specific to the micro system being analyzed, and this might be the reason why this barrier is not addressed in the reviewed literature. Based on the perspective by one respondent that farmers' lack of willingness to change might be due to requirements for profitability and efficiency, this barrier can be thought of as connected to the barrier of high investment costs and economic risk.

Furthermore, the lack of willingness to change due to uncertain, unknown or nonexistent profits of CE initiatives is also very much overlapping with the barrier of economic risk. The perspective of one respondent that CE initiatives might not be implemented even when profits can be expected, point to the issue of high transaction costs - the cost of establishing,

maintaining and using such initiatives are more visible than the profits they generate. This barrier was apparent in the reviewed literature as well, in the point that lack of logistics systems and outlets for surplus food constitute a barrier for reducing food waste in Norway. This is also arguably a problem of coordination. If economic actors are not required to make changes, they are likely to not go through with them without being certain that such changes will be profitable. However, if institutions requiring economic actors to implement CE initiatives were established, change is no longer only a question of economic logic. The underlying rationality of processes in the value chain could thus be shaped towards a more social rationality.

### Power structures in the value chain

The identified barrier of power structures in the value chain has not specifically been addressed in the reviewed literature. However, power is addressed by e.g., De Jesus & Mendonça (2018) as something which substantiates other barriers. This is also seen to be the case in this study. However, due to the emphasis put on how institutions are important for power relations in the integrated framework for a sustainable economy (Vatn, 2021) I argue that lifting power up as a barrier of its own allows for retroduction - it is part of assessing deeper levels of reality as a means to fully understand the phenomenon which is being studied (Fletcher, 2017). The other identified barrier points to *what* is hindering the transition, while the barrier of power might illuminate *why* the other barriers come to be. Respondents were therefore specifically asked about their perspectives on who holds power to create change in the value chain for vegetables in the Norwegian food system.

The barrier of power being concentrated in the value chain was highlighted by the majority of the respondents. Some examples of how concentrated power might add to other barriers will be provided here. One example regards how concentrated power relates to the barrier of lack of willingness to change: the perceived lack of willingness to change might actually be due to a lack of *ability* to change. This is exemplified by the perspectives on how farmers are not keen on changing their methods, which were contrasted with the perspective on how farmers are bound by strict expectations on product delivery, and thus the risk of change increases due to little positional power in decision-making processes regarding such product expectations.

The interlinkage of the barrier of concentrated power and consumer preferences is another example. The perspectives on whether consumers desire aesthetic vegetables or if this is a consequence of what businesses in the food system make available is a question of epistemic

and normative power. Those arguing that the strict standard requirements set for vegetables are affecting consumer choices, implies that the businesses setting these standards are the normative power holders, with an ability to influence and ultimately institutionalize certain preferences. On the other hand, if these standard requirements are merely a consequence of consumer choices, as some respondents argue, the normative power is more in the hands of the consumer. This would support the argument of those respondents who do not see concentrated power in the value chain as a barrier.

In the extension of these examples, it can be argued that investigating the various barriers up against how they are affected by power relations can contribute to creating appropriate measures for implementing CE practices. Requiring an actor to change when s/he does not have the ability to do so under current power structures in the system, will likely not be effective. Investigating power relations can give a deeper understanding of whether there are bottlenecks blocking change, and ultimately a fuller understanding of the context.

### **6.3 Drivers to a transition to a circular economy for vegetables**

In this section, the findings regarding the second research question will be discussed. The question reads as follows: *What are the drivers to a transition to a circular economy for vegetables in the Norwegian food system, as understood by leaders within businesses in this system?* The findings will be discussed in relation to the reviewed literature, and further explained through the theoretical concepts and framework from the theory chapter.

The identified drivers that were described in the analysis chapter are the following: increased knowledge and awareness; circular approaches are becoming profitable; political responsibility, incentives, and guidelines; collaboration and holistic thinking; new technologies; and strategic division of power. As with the barriers, many of the identified drivers are connected to each other and sometimes overlap. Furthermore, several of the drivers are also directly related to the barriers. Due to this, some repetitions might occur.

#### Increased knowledge and awareness

The driver of increasing knowledge and awareness is a central one in the reviewed literature. Just like it was highlighted in the literature that targeted governmental policies could fuel



awareness-raising (Neves & Marques, 2022), some respondents in this study point to the responsibility of the authorities to find measures for increasing knowledge and awareness. However, they point out that this must be a cooperative effort together with economic actors in the value chain for vegetables. This driver is thus related to the driver of increased collaboration, and points to the need for establishing new cooperative interaction rules between economic and political actors, both in order to increase knowledge levels for themselves and also to increase the knowledge levels of consumers. However, in order to ensure responsibilities are taken, there might be a need for some command-based interaction as well, where authorities define rules for how the measures to increase knowledge and awareness should be coordinated between political and economic actors.

Another central finding here is the perspective of several of the respondents that a generational shift is happening in relation to knowledge and awareness of sustainability and circularity in Norwegian society. This will ultimately lead to changes in economic processes and consumer choices, they argue. This corresponds well with the finding of Neves & Marques (2022) that young age is one of the drivers for awareness and action supporting CE. This suggests that institutional changes regarding norms and conventions coming from younger generations might ultimately mean changes in the resource regimes governing the economic processes in the value chain for vegetables in the Norwegian food system. However, as the need for changing the food system is urgent, it seems necessary to increase the awareness and knowledge of actors who currently hold positional and coordination power in order for knowledge and awareness to be drivers for a CE transition in the near future.

#### Circular approaches are becoming profitable

The respondents of this study highlight the driver that circular initiatives are becoming profitable. One respondent furthermore argued that sustainability can become a competitive advantage to the vegetable sector. However, these findings were contrasted in the literature, where it was pointed to food waste reduction initiatives not being economically sustainable due to high transaction costs. It might be the case that the initiatives the respondents of this study point to are ones with lower transaction costs than what they earn from implementing them. Furthermore, the transaction costs are higher when it is not identified where in the system the problem lies, and what measures might be appropriate. The causal mechanism for circular approaches becoming profitable might be that some actors succeed with CE initiatives and share

their experiences, which results in the transaction costs becoming lower for other actors who seek to implement similar CE initiatives.

#### Political responsibility, incentives, and guidelines

Several respondents of this study point out that if political actors take on a responsibility to create appropriate incentives and guidelines, it will drive the transition to a CE for vegetables. This was also found in the literature, both regarding CE in general and in the relation to the Norwegian food system. Both in this study and in the literature, it is mentioned that taxes and incentives could help guide economic actors in the desired direction. According to the respondents of this study, such policies could be useful in relation to product development, alternative packaging, industrial facilities, clean energy technologies, and awareness-raising. Policies that are clear on what activities are deemed good and what activities are deemed bad can be powerful in coordinating action towards results where sustainability is valued, thus institutionalizing certain interests. However, as some of the respondents argue, it is necessary to consider all possible side-effects before implementing regulations in order to avoid a problem being shifted from one area or actor to another (for example shifting a problem to a different actor in the value chain). In relation to the literature on critical points to CE pointing to the importance of considering net environmental sustainability of CE initiatives, considerations should also be done for possible side-effects in the meso and macro system (shifting problems to other value chains, other sectors, other countries, or other continents).

#### Collaboration and holistic thinking

The majority of the respondents pointed to collaboration and holistic thinking as pivotal for driving the transition to a CE for vegetables. This finding is also supported in the literature, where it is pointed to cooperation and collaboration being one of the main tools to overcome critical barriers (PACE, 2021). Respondents in this study who have already engaged in collaborations in the value chain perceive these as positive for succeeding with CE initiatives. It is also mentioned that there could be a potential in collaborating with other sectors for creating new products with food waste that are not related to human food, animal food, or energy generation, thus moving beyond value creation through the food waste hierarchy. This would furthermore imply systems thinking at the meso or macro level, not just the micro system consisting of the value chain for vegetables.

Several actors furthermore emphasize that more collaboration between economic and political actors would be important in order to facilitate the transition to a CE for vegetables. Some findings point to a possible tendency that if collaborations are more committing, there is a greater chance of generating results that are aligned with CE principles. There thus might be a need for political actors to use their positional power and coordination power to create resource regimes that require all relevant stakeholders to be on board in collaborative efforts to enhance a transition to CE for vegetables in the Norwegian food system. This is different from just demanding economic actors to adjust their practices through regulations; it points to measures where the interests of both economic and political actors are taken into consideration in the institutions guiding economic processes.

### New technologies

Several of the respondents point to the importance of new technologies to drive the transition to a CE for vegetables. Although the focus of this thesis has been on economic processes post-harvest, respondents have pointed to how technologies relating to pre-harvest activities will also likely facilitate CE approaches in processes later on in the system. This perspective further emphasizes the need for considering the greater system when assessing how transitioning to CE in a micro system might be achieved, in order to ensure that factors beyond the delimited system are considered - such as is the case with pre-harvest technologies affecting post-harvest processes, and ultimately CE achievements.

The potential of implementing technologies for collecting and analyzing data throughout the value chain is also an important driver mentioned by the respondents of this study. This relates to for example predicting future demands from customers to make more accurate orders to avoid surplus. Data can also be valuable for acquiring knowledge about waste fractions in order to create more apt sorting systems and thus give new possibilities for using certain wastes in new economic processes. However, it seems that technology is a driver that needs to be accompanied with other drivers, based on the findings in this study and in the literature. For example, respondents point to the need for apt regulations in order to benefit from the potential of new technologies. This points to political actors having to change the resource regimes in order to enable conditions where new technologies can be put into use. Furthermore, De Jesus & Mendonça (2018) found in their study that financial factors could act as a barrier even though technology was available for CE solutions, which point back to the driver of increased political

incentives and funding. These findings further emphasize the need for considering how various drivers work together and depend upon each other.

#### Strategic division of power

The findings of this study point to how power used in the right way can be a driver for a transition to CE for vegetables in the Norwegian food system. One perspective was that the current concentrated power in the value chain has enabled the implementation of some CE initiatives affecting the economic processes of several components. From this, it can be interpreted that the positional power of certain actors in the value chain has furthermore given them coordination power in relation to CE initiatives. However, other respondents perceive that certain actors would be able to do more for a transition to CE if the power was more divided throughout the value chain - this concerns especially actors in the farmer component and the food service component. It might be that both concentrated power and more divided power in the value chain can drive the transition to CE for vegetables - this needs to be assessed further. However, what is arguably the most important if the objective is to transition to a CE for vegetables in the Norwegian system, is that the actors in power have interests and values that align with these objectives, and that they are driven by a social rationality - a 'we' rationality - which ensures a transition in the whole system. If the power is more divided between actors with fragmented interests, this might make the coordination of the transition harder. However, if power is concentrated between a few actors that are mostly interested in promoting their own interests, this might lead to actors who wish to implement CE initiatives being unable to do so, due to the lack of positional power. Regardless, the underlying power structures of causal mechanisms in the food value chain are central to investigate further in order to identify how the division of power can best drive the transition to CE for vegetables in the Norwegian food system.

#### **6.4 Some further reflections**

In this section, some reflections based on the overall findings of this study will be discussed. First, some reflections on the ideological structures that seem to be building under current economic logic and processes will be presented. Next, a notion on the conceptualization of CE as a tool for further work is given.

#### **6.4.1 Perceiving the economy as embedded in nature**

Vatn's (2021) integrated framework for a sustainable economy conceptualizes the economy as an embedded system within the social system, which again is embedded in the biophysical system. Embedding the economy within nature points to the dependability of the inner systems (the economy and society) of the outer system (the biosphere). Put simply: if there was no earth, there would be no economy. Although this might seem to be an obvious remark, it seems necessary to point out - because current economic logic seems to reverse the order of which results should be prioritized in guiding our actions. The understandings of respondents in this study — which are in line with the findings in previous literature — point to a prioritization of economic growth over environmental benefits; the latter is only sought for if accompanied by the former. This points to underlying ideological structures which assume that economic growth is a prerequisite for humans to thrive. These ideological structures carry with them a mindset that quite often seems to neglect that the economy is dependent on the environment. Although respondents of this study emphasize that change is already happening and that CE approaches are becoming profitable, the underlying ideological structures might be the causal mechanisms for why there are persistent barriers of economic risk and thus an unwillingness to change in some areas. As changing the food system is a pressing issue, this leads to the question of whether necessary changes will come about fast enough to avoid the crossing of critical limits for the biophysical environment. Furthermore, it raises the question in relation to endless economic growth as an objective: if the use of resources already being part of the circle of resource flow is maximized, new resources will need to be added to make the economy grow. The circle then becomes a spiral - it is less pressing than a straight, upwards-facing line of resource use, but it will nevertheless lead to increased pressure on the biophysical environment, at least if growth is expected to happen faster than nature can regenerate (and as long as we have not found a way to only depend on infinite solar energy for energy processes, as discussed in the literature review). The irony of it all is that growth cannot happen if the biosphere it depends on collapses. Therefore, it is crucial to consider the ideological structures guiding economic processes, and whether they will support the needed actions to create sustainable change.

#### **6.4.2 Should circular economy be applied as a concept?**

Although this thesis explores the application of CE to the value chain of vegetables in the Norwegian food system, it can be argued whether it is a term that should be applied by everyone working in or with the food system. It is not a prerequisite for generating change - actions that

can be termed 'circular' will have the same environmental, economic or social effect under a different name. As some of the respondents pointed out, the concept might even feel overcomplicated for some actors, as it has yet not been applied much when talking about the food system in the general public, and there is already a jungle of terms fighting for momentum in the sustainable development discourse. However, the CE can arguably help conceptualize which institutional changes are needed to create a sustainable food system. It can serve as a strategic framework that ensures a systems approach to finding solutions, which takes into consideration the interconnectedness of processes from the economic, civil society, and biophysical sphere. However, if applied, it will be crucial to ensure that the term is conceptualized and understood in the same way by all involved stakeholders. With the literature showing that over 100 definitions of CE exist, and this study showing that some of the respondents understand the concept differently than others, there is a need to work towards a common understanding of what CE really means in the given context. Furthermore, it will be crucial to follow up on the critiques of CE mentioned in the literature: ensuring that the social sustainability and net global sustainability are being encompassed in CE initiatives, as well as acknowledging the limits to creating a fully circular system. Thus, if all these aspects are taken into consideration, CE can arguably be a useful concept for those actors who have the power to change the institutions that guide actions in the food system.

## 7.0 Conclusion

In this chapter, this study will be concluded by summarizing the main findings relating to the research aim and formulated research questions. Furthermore, the value and contribution of this research will be discussed, and opportunities for future research will be proposed.

The aim of this thesis has been to investigate barriers and drivers to a transition to a CE for vegetables in the Norwegian food system. CE is a concept being ever more frequently mentioned in political, corporate, and academic discourses as a possible strategy for creating sustainable development in various fields. In recent years, CE has also been applied to food systems. However, efforts to create more circular food systems are still in their early phases, and as in all CE-relevant fields, there is still a long way to go in bringing theory into practice. This research aims to help fill the knowledge gaps on what factors affect a transition to a CE for vegetables in Norway and, hopefully, aid in the work of making such a transition happen. In order to do so, the following questions have been investigated: *Q1: What are the barriers to a transition to a circular economy for vegetables in the Norwegian food system, as understood by leaders within businesses in this system?* and *Q2: What are the drivers to a transition to a circular economy for vegetables in the Norwegian food system, as understood by leaders within businesses in this system?*

Through a qualitative case study, perspectives were collected from leaders within businesses who represent various components of the value chain for vegetables in Norway, ranging from farmers to waste management. The research questions have been investigated through a systems perspective, with the ambition of gaining a greater understanding of how the barriers and drivers are relevant and manifested across the value chain, as well as how these factors are connected to other actors, institutions, and spheres in the greater system. I argue that such an approach has been appropriate when investigating prospects for a transition to a CE, as CE is ultimately about creating systems change.

Regarding the first research question, which is focused on barriers, the results indicate that the majority of perceived barriers are relevant to several of the components in the value chain, even though they might be manifested in different ways. Some of the most frequently identified barriers include hindering regulations; lack of political incentives and economic risk; the size and standardization of economic processes; consumer preferences; the conflict between

vegetables and supporting resources; knowledge gaps and lack of awareness; lack of holistic thinking and collaboration; lack of willingness to change; and power structures in the value chain.

The second research question addresses the factors which are perceived as possible or existing drivers to the transition to a CE for vegetables. Also here, many of the identified factors are common to several, if not all of the components in the value chain. Several drivers can be seen as direct responses to the identified barriers, while some are also separate factors that are enabling circular initiatives (e.g., new technologies). Based on the perspectives of the respondents in this study, it can be argued that the transition to a CE for vegetables in the Norwegian food system has already begun (although it might not be termed that way), as several projects relating to CE have already been initiated. However, the findings also indicate that to accelerate the transition, there is need for efforts in several areas. The main identified drivers are: increased knowledge and awareness; circular approaches are becoming profitable; political responsibility, incentives, and guidelines; collaboration and holistic thinking; new technologies; and strategic division of power.

Although the barriers and drivers identified by the respondents of this study have been treated thematically both in the analysis and discussion for structuring purposes, it is central to point out that they are often overlapping or interlinked. Furthermore, several of the identified factors seem to be dependent on each other. For example, to unleash the potential of new technologies, it appears to be necessary to have appropriate political regulations and incentives in place. Moreover, increased collaboration and holistic thinking, both within and across the value chain for vegetables as well as between political and economic actors, seems to be necessary in order to succeed with most of the other identified drivers.

Many of the factors affecting a CE transition that have been identified in this research support the findings in existing literature on barriers and drivers to CE approaches in general, to CE in the agri-food system and to the Norwegian food system specifically. What is arguably the most novel contribution of this research, is the consideration of power structures as a factor of its own. I have argued that through explicitly investigating power structures, it might be possible to move beyond identifying *what* the different barriers and drivers are, to *why* they come to be. It is furthermore important to assess what type of rationality, values and interests guide the actors in power, as this affects the results of economic processes. Moving one step further, I



have argued that it is necessary to assess the ideological structures that underbuilds current economic rationality and values. Through investigating some of the causal mechanisms behind the tendencies in the system, it can be argued that several of the identified factors are embedded in ideological structures fixated on economic growth, where economic value is given preference over environmental benefits. Although circular approaches are increasingly being recognized as profitable, I have questioned whether, in the long run, an endless quest for growth should be the cornerstone of an economic system dependent on the biophysical environment, which is mostly a closed system - even if the potential of CE is maximized.

The findings of this study cannot be generalized to the whole value chain for vegetables in the Norwegian food system. Nevertheless, this study conveys valuable information for further research on how to enable a transition to a CE for vegetables. Future contributions to the field could for example apply the findings from this research as a base for undertaking a quantitative study, in order to assess whether the results are representative to the wider population. Furthermore, it could be useful to conduct a more in-depth investigation of each component of the value chain separately, in order to map out more concrete barriers and drivers for each component, based on the perspectives of larger samples than what has been possible in this study. Moreover, assessing the perspectives of other relevant actors beyond the businesses working in the value chain would also contribute to a more holistic understanding of barriers and drivers to a transition to CE for vegetables. This could for example be governmental bodies and municipalities which are involved in the regulation of the economic processes in the value chain. It would also be beneficial to gather perspectives from consumers on what they believe to be barriers and drivers to such as transition. Further knowledge in the mentioned areas can help ensure the development of appropriate measures to facilitate CE initiatives in the value chain for vegetables in the Norwegian food system.

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## 9.0 Appendices

### Appendix 1. Interview guide<sup>6</sup>

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| <b>INTERVJUGUIDE</b>   |
| <i>Intervjuobjekt:</i>   |
| <b>Introduksjon</b>  |
| <p><i>Velkommen, og takk for at du tok deg tid til denne samtalen</i></p> <ul style="list-style-type: none"><li>• <i>Litt om forskningsprosjektet:</i><ul style="list-style-type: none"><li>○ <i>Matsystemet løftes frem som et system med mye å vinne på sirkulære tilnærminger.</i></li><li>○ <i>Formålet med dette masterprosjektet er å undersøke barrierer og drivere for sirkulære tilnærminger for grønnsaker i det norske matsystemet, basert på perspektiver fra ledere i bedrifter i de ulike delene av verdikjeden.</i></li></ul></li></ul> |
| <b>Spørsmålskategori</b>   |
| <b>Bakgrunnsspørsmål</b>   |
| <p><b>Innledende:</b></p> <p>Før vi starter, har du noen spørsmål eller er det noe du tenker jeg bør vite om?</p>  |
| <p><b>Om bedrift og intervjuobjekt:</b></p> <ul style="list-style-type: none"><li>• Kan du fortelle meg litt om deg selv og bedriften du jobber i?</li><li>• Hvor i verdikjeden befinner bedriften seg?</li><li>• Hvilken stilling har du?</li><li>• Hvor lenge du har jobbet der?</li><li>• Hvordan vil du beskrive bedriftens fokus på bærekraft (hvis relevant)?</li></ul>  |
| <p><b>Sirkulærøkonomi og matsystemet:</b></p> <ul style="list-style-type: none"><li>• Hvordan tolker du begrepet sirkulærøkonomi?</li></ul> <p><i>Sirkulærøkonomi er et systembasert rammeverk som skal bidra til å få stoppet globale utfordringer som klimaendringer, tap av biologisk mangfold, avfall og forurensning.</i></p>   |

<sup>6</sup> The interview guide was adjusted to each specific sampling group. This included a reformulation of certain questions, and also a few questions added as possible follow-up questions concerning specific regulatory, economic, socio-cultural, technological, and biophysical factors to their group.



Sirkulærøkonomi kan ses å være basert på tre prinsipper:

- *Eliminere avfall og forurensning*
- *Sirkulere materialer og produkter på deres høyeste mulige verdi*
- *Regenerere naturen*
  
- Hvordan tenker du at sirkulærøkonomi er relevant for arbeidet med grønnsaker i matsystemet?
  - *(Hvis opplevd som relevant):*
    - Hvis dere jobber med sirkulære tilnærminger i din bedrift: på hvilke måter gjør dere det?
    - På hvilke måter kunne dere ha jobbet med sirkulære tilnærminger i din bedrift?

### Faktorer som hindrer sirkulære tilnærminger

- Hvilke faktorer mener du er til **hinder** for å kunne ha sirkulære tilnærminger i arbeidet med grønnsaker i det norske matsystemet?
  - Hvilke faktorer **innad i din bedrift** opplever du at er til hinder?
  - Hvilke faktorer har du inntrykk av at er til hinder **for ditt ledd i verdikjeden** spesielt?
  - Hvilke faktorer har du inntrykk av at er til hinder **i andre ledd i verdikjeden?**
  - Hvilke faktorer har du inntrykk av at er til hinder **for grønnsaksektoren i sin helhet?**

### Tilleggsspørsmål (tilpasses etter svar i de åpne spørsmålene)

- Hvilke **lover eller reguleringer** opplever du at er til hinder for å ha sirkulære tilnærminger i arbeidet med grønnsaker i det norske matsystemet?
  - Hvilke **regler og retningslinjer innad i din bedrift** har du inntrykk av at er til hinder?
    - hva tenker du kan være mulige løsninger på disse hindrene?
  - Hvilke lover eller reguleringer har du inntrykk av at er til hinder **for ditt ledd i produktkjeden** spesielt?
    - hva tenker du kan være mulige løsninger på disse hindrene?
  - Hvilke lover eller reguleringer har du inntrykk av at er til hinder i **andre ledd i verdikjeden?**
    - hva tenker du kan være mulige løsninger på disse hindrene?
  - Hvilke lover eller reguleringer har du inntrykk av at er til hinder **for grønnsaksektoren i sin helhet?**
    - hva tenker du kan være mulige løsninger på disse hindrene?
  - Hvilke **politiske aktører/institusjoner** er sentrale i påvirkningen her?
  
- Hvilke **sosiale eller kulturelle faktorer** opplever du at er til hinder for å ha sirkulære tilnærminger i arbeidet med grønnsaker i det norske matsystemet?

- Hvilke sosiale eller kulturelle faktorer **innad i din bedrift** har du inntrykk av at er til hinder?
  - hva tenker du kan være mulige løsninger på disse hindrene?
- Hvilke sosiale eller kulturelle faktorer har du inntrykk av at er til hinder for **ditt ledd i verdikjeden** spesielt?
  - hva tenker du kan være mulige løsninger på disse hindrene?
- Hvilke sosiale eller kulturelle faktorer har du inntrykk av at er til hinder i **andre ledd i produktkjeden?**
  - hva tenker du kan være mulige løsninger på disse hindrene?
- Hvilke sosiale eller kulturelle faktorer har du inntrykk av at er til hinder for sirkulære tilnærminger i **grønnsaksektoren i sin helhet?**
  - hva tenker du kan være mulige løsninger på disse hindrene?

- Hvilke **teknologiske faktorer** opplever du at er til hinder for å ha sirkulære tilnærminger i arbeidet med grønnsaker i det norske matsystemet?
  - Hvilke teknologiske faktorer **innad i din bedrift** har du inntrykk av at er til hinder?
    - hva tenker du kan være mulige løsninger på disse hindrene?
  - Hvilke teknologiske faktorer har du inntrykk av at er til hinder **for ditt ledd i verdikjeden** spesielt?
    - hva tenker du kan være mulige løsninger på disse hindrene?
  - Hvilke teknologiske faktorer har du inntrykk av at er til hinder i **andre ledd i verdikjeden?**
    - hva tenker du kan være mulige løsninger på disse hindrene?
  - Hvilke teknologiske faktorer har du inntrykk av at er til **hinder for grønnsaksektoren i sin helhet?**
    - hva tenker du kan være mulige løsninger på disse hindrene?

- Hvilke **økonomiske faktorer** opplever du at er til hinder for å ha sirkulære tilnærminger i arbeidet med grønnsaker i det norske matsystemet?
  - Hvilke økonomiske faktorer **innad i din bedrift** har du inntrykk av at er til hinder?
    - hva tenker du kan være mulige løsninger på disse hindrene?
  - Hvilke økonomiske faktorer har du inntrykk av at er til hinder **for ditt ledd i verdikjeden spesielt?**
    - hva tenker du kan være mulige løsninger på disse hindrene?
  - Hvilke økonomiske faktorer har du inntrykk av at er til hinder i **andre ledd i verdikjeden?**
    - hva tenker du kan være mulige løsninger på disse hindrene?
  - Hvilke økonomiske faktorer har du inntrykk av at er til hinder **for grønnsaksektoren i sin helhet?**

- hva tenker du kan være mulige løsninger på disse hindrene?
- Hvilke **bedrifter** er sentrale i påvirkningen her?
- Hvilken rolle spiller **forbrukerne** her?

- Hvilke ***naturmessige faktorer (utenfor menneskelig kontroll)*** opplever du at er til hinder for å ha sirkulære tilnærminger i arbeidet med grønnsaker i det norske matsystemet?
  - Hvilke naturmessige faktorer **innad i din bedrift** har du inntrykk av at er til hinder?
    - hva tenker du kan være mulige løsninger på disse hindrene?
  - Hvilke naturmessige faktorer har du inntrykk av at er til hinder for **ditt ledd i verdikjeden** spesielt?
    - hva tenker du kan være mulige løsninger på disse hindrene?
  - Hvilke naturmessige faktorer har du inntrykk av at er til hinder i **andre ledd i verdikjeden**?
    - hva tenker du kan være mulige løsninger på disse hindrene?
  - Hvilke naturmessige faktorer har du inntrykk av at er til hinder **for grønnsaksektoren i sin helhet**?
    - hva tenker du kan være mulige løsninger på disse hindrene?

### Faktorer som legger til rette for sirkulære tilnærminger

- Hvilke faktorer opplever du at **legger til rette for (eller ville lagt til rette for)** å kunne ha sirkulære tilnærminger i arbeidet med grønnsaker i det norske matsystemet?
  - Hvilke faktorer **innad i din bedrift** har du inntrykk av at legger til rette for/driver sirkulære initiativer?
  - Hvilke faktorer har du inntrykk av at til legger til rette for/driver sirkulære initiativer **i ditt ledd i verdikjeden spesielt**?
  - Er det noen faktorer du har inntrykk av at legger til rette for/driver sirkulære initiativer **i andre ledd i verdikjeden**?
  - Er det noen faktorer du har inntrykk av at legger til rette for/driver sirkulære initiativer **for grønnsaksektoren i sin helhet**?

### Tilleggsspørsmål (tilpasses etter svar i de åpne spørsmålene)

- Hvilke **lover eller reguleringer** opplever du kan være med å legge til rette for å ha sirkulære tilnærminger i arbeidet med grønnsaker i det norske matsystemet?
  - Hvilke regler og retningslinjer **innad i din bedrift** opplever du kan være med å legge til rette for det?
  - Hvilke lover eller reguleringer opplever du kan være med å legge til rette for det **i ditt ledd i verdikjeden spesielt**?

- Hvilke lover eller reguleringer opplever du kan være med å legge til rette for det **i andre ledd i verdikjeden?**
- Hvilke lover eller reguleringer opplever du kan være med å legge til rette for sirkulære tilnæringer **i grønnsaksektoren i sin helhet?**
- Hvilke **politiske aktører/institusjoner** er sentrale i påvirkningen her?

- Hvilke *sosiale eller kulturelle faktorer* opplever du kan være med å legge til rette for å ha sirkulære tilnæringer i arbeidet med grønnsaker i det norske matsystemet?
  - Hvilke sosiale eller kulturelle faktorer **innad i din bedrift** opplever du kan være med å legge til rette for det?
  - Hvilke sosiale eller kulturelle faktorer opplever du kan være med å legge til rette for det for **ditt ledd i verdikjeden spesielt?**
  - Hvilke sosiale eller kulturelle faktorer opplever du kan være med å legge til rette for det i andre ledd i **verdikjeden?**
  - Hvilke sosiale eller kulturelle faktorer opplever du kan være med å legge til rette for sirkulære tilnæringer **i grønnsaksektoren i sin helhet?**

- Hvilke *teknologiske faktorer* opplever du kan være med å legge til rette for å ha sirkulære tilnæringer i arbeidet med grønnsaker i det norske matsystemet?
  - Hvilke teknologiske faktorer **innad i din bedrift** opplever du kan være med å legge til rette for det?
  - Hvilke teknologiske faktorer opplever du kan være med å legge til rette for det for **ditt ledd i verdikjeden spesielt?**
  - Hvilke teknologiske faktorer opplever du kan være med å legge til rette for det **i andre ledd i verdikjeden?**
  - Hvilke teknologiske faktorer opplever du kan være med å legge til rette for sirkulære tilnæringer **i grønnsaksektoren i sin helhet?**
  - Hvilke **bedrifter** er sentrale i påvirkningen her?
  - Hvilken rolle spiller **forbrukerne** her?

- Hvilke *økonomiske faktorer* opplever du kan være med å legge til rette for å ha sirkulære tilnæringer i arbeidet med grønnsaker i det norske matsystemet?
  - Hvilke økonomiske faktorer **innad i din bedrift** opplever du kan være med å legge til rette for det?

- Hvilke økonomiske faktorer opplever du kan være med å legge til rette for det **for ditt ledd i verdikjeden spesielt?**
- Hvilke økonomiske faktorer opplever du kan være med å legge til rette for det **i andre ledd i verdikjeden?**
- Hvilke økonomiske faktorer opplever du kan være med å legge til rette for sirkulære tilnærminger **i grønnsaksektoren i sin helhet?**

- Hvilke *naturmessige faktorer* (utenfor menneskelig kontroll) opplever du kan være med å legge til rette for å ha sirkulære tilnærminger i arbeidet med grønnsaker i det norske matsystemet?
  - Hvilke naturmessige faktorer **innad i din bedrift** opplever du kan være med å legge til rette for det?
- Hvilke naturmessige faktorer opplever du kan være med å legge til rette for det **for ditt ledd i verdikjeden spesielt?**
- Hvilke naturmessige faktorer opplever du kan være med å legge til rette for det **i andre ledd i verdikjeden?**
- Hvilke naturmessige faktorer opplever du kan være med å legge til rette for sirkulære tilnærminger **i grønnsaksektoren i sin helhet?**

### Interaksjon og samarbeid

- Hvilken rolle kan samarbeid spille i arbeidet mot et mer sirkulært system?
- Hvilke samhandlingsavtaler har din bedrift med andre bedrifter i verdikjeden?
- Hvilken rolle spiller disse avtalene for å kunne lykkes med sirkulære tilnærminger i deres bedrift?
- Har dere avtaler med andre aktører som sikrer verdivinning på grønnsakene, eller som reduserer avfall?
- Er avtalene tilfeldige eller regulerte?
- Hvordan håndheves disse avtalene?

### Ansvar, makt og avmakt

- Hvilke aktører i samfunnet mener du har et ansvar i omstillingen til en mer sirkulær økonomi?
- Hvordan mener du fordelingen av ansvar mellom disse aktørene bør være?
- I hvilken grad opplever du at du med din posisjon i matsystemet har makt til å skape endringer?
- Hvilke aktører i matsystemet opplever du at har reell makt til å skape endringer?

### Avslutningsspørsmål

- Er det noe vi ikke har snakket om som du har lyst til å nevne?
- Hva mener du er det viktigste vi har snakket om i dette intervjuet?

*Tusen takk for at du tok deg tid til å svare!*

## Appendix 2. Consent form<sup>7</sup>

### Vil du delta i forskningsprosjektet

#### *Barrierer og fremmere for en overgang til sirkulærøkonomi for grønnsaker i det norske matsystemet*

Dette er et spørsmål til deg om å delta i et forskningsprosjekt hvor formålet er å undersøke barrierer og fremmere for mer sirkulærøkonomiske tilnærminger i arbeidet med grønnsaker i det norske matsystemet. I dette skrevet gir vi deg informasjon om målene for prosjektet og hva deltakelse vil innebære for deg.

#### **Formål**

Forskningsprosjektet er til en masteroppgave i studieprogrammet internasjonale miljøstudier ved Norges miljø- og biovitenskapelige universitet. Formålet med prosjektet er å undersøke hvilke faktorer bedriftsledere i matindustrien opplever at enten hindrer eller legger til rette for sirkulærøkonomiske tilnærminger i det norske matsystemet, og da spesielt med fokus på grønnsaker. For datainnsamlingen er det et mål å intervjuere ledere i bedrifter gjennom hele verdikjeden, fra produksjon til avfallshåndtering.

Masterprosjektet vil gjennomføres på engelsk. Problemstillingene som skal analyseres i denne masteroppgaven er følgende:

- Q1: What are the barriers for a transition into a circular economy for vegetables in the Norwegian food system, as understood by leaders in businesses working in the food system?
- Q2: What could be factors which enhance a transition into a circular economy for vegetables in the Norwegian food system, as understood by leaders in businesses working in the food system?

#### **Hvem er ansvarlig for forskningsprosjektet?**

Institutt for internasjonale miljø- og utviklingsstudier (Noragric) ved Norges miljø- og biovitenskapelige universitet (NMBU) er ansvarlig for prosjektet.

#### **Hvorfor får du spørsmål om å delta?**

Du får spørsmål om å delta i dette prosjektet fordi du er bedriftsleder eller har en lederfunksjon i en bedrift som jobber med grønnsaker i det norske matsystemet. Målet i dette prosjektet er å rekruttere deltakere som til sammen representerer hele verdikjeden, herunder bønder, bedrifter i matindustrien, grossister, dagligvare, servering og også avfallshåndtering. Bedriftslederne som blir kontaktet er valgt ut basert på deres rolle, funksjon og posisjon i det norske matmarkedet. I første omgang er det omtrent 20 bedriftsledere som mottar henvendelsen.

#### **Hva innebærer det for deg å delta?**

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<sup>7</sup> The formulations of the research questions have been adjusted a bit since the consent form was sent out.

Hvis du velger å delta i prosjektet, innebærer det at du stiller til et intervju som vil ta ca 45-60 minutter. Intervjuet vil bestå av spørsmål om hvilke faktorer du opplever at utgjør barrierer for sirkulære tilnærminger i arbeidet med grønnsaker i det norske matsystemet, samt hvilke faktorer du opplever kan legge til rette for slikt arbeid. Det vil bli tatt lyd- eller skjermopptak av intervjuet, avhengig av om intervjuet gjennomføres digitalt eller fysisk. Det vil også bli tatt notater.

### **Det er frivillig å delta**

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

### **Ditt personvern – hvordan vi oppbevarer og bruker dine opplysninger**

Vi vil bare bruke opplysningene om deg til formålene vi har fortalt om i dette skrivet. Vi behandler opplysningene konfidensielt og i samsvar med personvernregelverket. Det vil kun være veileder og student som har tilgang på opplysningene gjennom prosjektet. Navnet og kontaktopplysningene dine vil også erstattes med en kode som lagres på egen navneliste adskilt fra øvrige data for å sikre at ingen uvedkommende får tilgang til opplysningene.

Som deltaker i dette prosjektet vil du anonymiseres i publikasjonen. Dette gjelder både deg som enkeltperson og bedriften du jobber i.

### **Hva skjer med opplysningene dine når vi avslutter forskningsprosjektet?**

Opplysningene anonymiseres når prosjektet avsluttes/oppgaven er godkjent, noe som etter planen er mai 2022. Etter prosjektets slutt vil personopplysninger og opptak av intervju slettes.

### **Hva gir oss rett til å behandle personopplysninger om deg?**

Vi behandler opplysninger om deg basert på ditt samtykke.

På oppdrag fra Institutt for internasjonale miljø- og utviklingsstudier (Noragric) ved Norges miljø- og biovitenskapelige universitet (NMBU) har NSD – Norsk senter for forskningsdata AS vurdert at behandlingen av personopplysninger i dette prosjektet er i samsvar med personvernregelverket.

### **Dine rettigheter**

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

- innsyn i hvilke opplysninger vi behandler om deg, og å få utlevert en kopi av opplysningene
- å få rettet opplysninger om deg som er feil eller misvisende
- å få slettet personopplysninger om deg
- å sende klage til Datatilsynet om behandlingen av dine personopplysninger

Hvis du har spørsmål til studien, eller ønsker å vite mer om eller benytte deg av dine rettigheter, ta kontakt med:

- Institutt for internasjonale miljø- og utviklingsstudier (Noragric), Norges miljø- og biovitenskapelige universitet ved Arild Vatn (veileder) på epost ([arild.vatn@nmbu.no](mailto:arild.vatn@nmbu.no)) eller på telefon: 415 17 780, eller Andrea Christine Kunz Skrede (student) på epost ([andrea.christine.kunz.skrede@nmbu.no](mailto:andrea.christine.kunz.skrede@nmbu.no)) eller på telefon: 473 06 631.



- Vårt personvernombud: Hanne Pernille Gulbrandsen på epost (personvernombud@nmbu.no) eller på telefon: 402 81 558.

Hvis du har spørsmål knyttet til NSD sin vurdering av prosjektet, kan du ta kontakt med:

- NSD – Norsk senter for forskningsdata AS på epost ([personverntjenester@nsd.no](mailto:personverntjenester@nsd.no)) eller på telefon: 53 21 15 00.

Med vennlig hilsen

Arild Vatn  
(Forsker/veileder)

Andrea Christine Kunz Skrede  
(Student)

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## Samtykkeerklæring

Jeg har mottatt og forstått informasjon om prosjektet *Barrierer og fremmere for en overgang til sirkulærøkonomi for grønnsaker i det norske matsystemet*, og har fått anledning til å stille spørsmål. Jeg samtykker til:

- å delta i intervju

Jeg samtykker til at mine opplysninger behandles frem til prosjektet er avsluttet

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(Signert av prosjektdeltaker, dato)



**Norges miljø- og biovitenskapelige universitet**  
Noregs miljø- og biovitenskapelige universitet  
Norwegian University of Life Sciences

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