Tampere University

TARU LEHTOKUNNAS

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A multi-sited ethnography on food waste practices in Finnish supermarkets, households and biogas plants

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To my grandmother, Aila Lehtokunnas

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It is very difficult to describe the feeling of getting this PhD dissertation done. I feel really astonished by how quickly the time has passed but, at the same time, it feels like a lot has happened during these years. At the beginning of my PhD studies, I often felt rather suspicious of whether I would ever come to complete this thesis. Little by little, I realised, however, that it is possible to finalise it. The most important thing I have learned during this journey is that, at its best, doing science is about admitting the impossibility of knowing everything and just doing things that inspire you, regardless of sometimes feeling completely ignorant and stupid. However, accomplishing this milestone without people who supported me, worked with me, and helped me to believe in myself when I felt stupid, worried, and frustrated, would have obviously never been possible.

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my everyday life without our daily routine of watching cat videos. I am most grateful that you are in my life. I love you.

At my home office in Hatanpää, Tampere, May 2nd, 2023,
Taru Lehtokunnas

ABSTRACT

This article-based dissertation employs a practice-based approach to examine how food waste and the circular economy (CE) are enacted in three nodal points of the food consumption process: Finnish supermarkets, households and biogas plants. In Finnish and EU policies, reducing consumer and retail food waste as well as more efficient utilisation of biowaste are considered essential components of the transition towards a CE in the food system. The CE can be considered, among other things, a policy, business model and vision. The ultimate goal of the CE transition is to depart from the current unsustainable linear economic model, which is primarily based on resource exploitation. This dissertation utilises a multi-sited ethnographic approach to examine how the CE of food waste is enacted and complicated in concrete everyday practices in the observed environments.

This dissertation is positioned at the intersection of social scientific waste studies and research concerning the CE. The majority of previous research on CE has focused, for example, on industrial processes, policy enactment of the CE and business model design. The systemic and societal shift that the CE transition requires is not often highlighted in this literature. However, a growing body of social scientific research has started to call for a critical confrontation of the CE concept and underlining the importance of examining the everyday efforts that the CE transition requires.

This thesis follows the journey that food undergoes in the final phases of the food chain, highlighting the possibilities and challenges of transforming food waste and related practices circular. The thesis frames the CE transition as a societal process that is both enacted in and complicated by concrete, hands-on everyday practices. The study is based on a multi-sited ethnography conducted in Finland. The research data comprise ethnographic fieldwork in a supermarket and two biogas plants. In addition, interviews were conducted with managers and experts working in the biogas sector. To study household practices, food waste diaries were collected from Finnish households. Furthermore, the study utilises fieldnotes from leftover cooking workshops organised in collaboration with the Finnish Martha Organization and Wastebusters research group. The data were collected between 2018 and 2021.

The thesis contributes to the fields of social scientific waste studies and research on the CE. It makes an empirical contribution to social scientific waste studies by ethnographically following the changing ways of dealing with and relating to food waste at the final stages of the food consumption process. In doing so, it brings out how food waste is enacted differently in socio-material practices at different sites, thus showing the different realities and meanings that waste may have. Further, the dissertation contributes to research on the CE by highlighting how food waste is circulated in practice at different sites, which types of leakages and disruptions this process entails and how the CE is enacted differently in these situated practices. Overall, this study shows that there is no CE without the everyday practices that always enact both waste and the CE differently depending on the situation, and that the everyday practices of circulating and reducing food waste do not offer complete mastery over waste materials.

TIIVISTELMÄ

Tarkastelen tässä artikkeliväitöskirjassa käytäntöperusteisesta näkökulmasta sitä, miten ruokahävikkiä ja kiertotaloutta tuotetaan kolmessa ruoan kulutusprosessin solmukohdassa: suomalaisissa ruokakaupoissa, kotitalouksissa ja biokaasulaitoksissa. Kuluttajien ja vähittäiskaupan ruokahävikin vähentäminen sekä biojätteen tehokas hyödyntäminen ovat ruokajärjestelmän kiertotaloussiirtymän keskeisiä komponentteja sekä Suomen että EU:n poliittisissa ohjelmissa. Kiertotalous voidaan nähdä muun muassa poliittisena ohjelmana, liiketoimintamallina ja visiona. Kiertotalouden perimmäinen päämäärä on luopua nykyisestä kestämättömästä lineaarisesta talousmallista, joka perustuu resurssien ylikulutukselle. Hyödynnän tässä väitöskirjassa monipaikkaisen etnografian menetelmiä tutkiakseni, miten ruokahävikin kiertotaloutta toteutetaan ja haastetaan jokapäiväisissä käytännöissä tutkituissa ympäristöissä.

Tämä väitöskirja paikantuu yhteiskuntatieteellisen jätetutkimuksen ja kiertotaloustutkimuksen rajapinnalle. Suuri osa tähänastisesta kiertotalouteen liittyvästä tutkimuksesta keskittyy muun muassa teollisuuden prosesseihin, kiertotalouden poliittiseen toimenpanoon ja liiketoimintamallien muotoiluun, mutta kiertotaloussiirtymän vaatima systeeminen ja yhteiskunnallinen muutos on jäänyt usein vähemmälle tarkastelulle. Yhteiskuntatieteellinen tutkimus on kuitenkin kasvavissa määrin alkanut kiinnittää huomiota kiertotalouskäsitteen kriittisen tarkastelun tarpeeseen sekä korostaa kiertotaloussiirtymän vaatiman jokapäiväisen vaivannäön tutkimisen tärkeyttä.

Tämä väitöskirja seuraa ruoan matkaa ruokaketjun loppupäässä ja tekee näkyväksi, millaisia mahdollisuuksia ja haasteita ruokahävikkikäytäntöjen muuttamiseen sekä ruokahävikin kierron luomiseen liittyy. Väitöskirja kehystää kiertotaloussiirtymän yhteiskunnalliseksi prosessiksi, joka yhtäältä pannaan täytäntöön, mutta joka myös toisaalta hankaloituu jokapäiväisten käytäntöjen myötä. Tutkimus perustuu Suomessa toteutettuun monipaikkaiseen etnografiaan. Tutkimuksen aineisto koostuu etnografisesta havainnoinnista ruokakaupassa ja kahdessa biokaasulaitoksessa, sekä biokaasualalla työskentelevien asiantuntijoiden ja esihenkilöasemassa olevien työntekijöiden haastatteluista. Kotitalouksia koskeva aineisto koostuu ruokahävikkipäiväkirjoista sekä etnografisesta materiaalista, joka on

kerätty Marttajärjestön ja Wastebusters-tutkimusryhmän yhdessä järjestämissä ruokahävikkikokkaustyöpajoissa. Aineisto on kerätty vuosien 2018 ja 2021 välillä.

Tutkimuksen keskeiset kontribuutiot sijoittuvat yhteiskuntatieteellisen jätetutkimuksen ja kiertotaloustutkimuksen kentille. Tutkimus tuottaa uutta tietoa yhteiskuntatieteelliseen jätetutkimukseen seuraamalla etnografisesti ruokahävikin käsittelyn ja siihen suhtautumisen muuttuvia tapoja ruoan kulutusprosessin loppuosissa. Samalla se osoittaa, miten ruokahävikkiä tuotetaan eri tavoin sosiomateriaalisissa käytännöissä eri kentillä, tuoden näin esille millaisia erilaisia mahdollisia todellisuuksia ja merkityksiä jätteellä voi olla. Väitöskirja kontribuoi kiertotaloustutkimukseen osoittamalla, miten ruokahävikin kierto tehdään käytännössä eri ympäristöissä, millaisia vuotoja ja häiriötekijöitä tähän prosessiin sisältyy, sekä miten kiertotalous pannaan käytäntöön eri tavoin tilanteisissa käytännöissä. Kokonaisuudessaan tutkimuksen tulokset osoittavat, että kiertotaloutta ei voi olla olemassa ilman päivittäisiä käytäntöjä, jotka tuottavat sekä jätettä että kiertotaloutta eri tavoin tilanteesta riippuen. Tutkimus myös tuo ilmi, että jokapäiväiset jätteen kiertoa tuottavat käytännöt eivät mahdollista jätteen täydellistä kontrollointia.

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ABBREVIATIONS AND INDICATIONS

ANT: Actor–Network Theory
CE: Circular Economy
STS: Science and Technology Studies
[...]: Removed text passage

ORIGINAL PUBLICATIONS

The following articles provide the basis for this dissertation. In the text, I refer to them by the Roman numerals indicated below.

Article I Lehtokunnas, Taru & Pyyhtinen, Olli (2022). Food, excess, wastage and waste: An ethnography of the practices of framing food products in the Finnish retail sector. *Geoforum*, *129*, 28–38. https://doi.org/10.1016/j.geoforum.2022.01.004

Article II Lehtokunnas, Taru, Mattila, Malla, Närvänen, Elina & Mesiranta, Nina (2022). Towards a circular economy in food consumption: Food waste reduction practices as ethical work. *Journal of Consumer Culture, 22*(1), 227–245. https://doi.org/10.1177/1469540520926252

Article III Lehtokunnas, Taru & Pyyhtinen, Olli (2023). Biowaste as fluid matter: Valuing biogas and biofertilisers as assets in the Finnish biogas sector. *Journal of Cultural Economy 16*(2), 277–293. https://doi.org/10.1080/17530350.2023.2169324

Article IV Lehtokunnas, Taru. The circular economy futures in the making: Transformativity and object ontologies in food waste practices in Finnish households, supermarkets and biogas plants. Manuscript submitted for publication.

AUTHOR'S CONTRIBUTION

Article I: I played a major role in the study's design and wrote the majority of the analysis. I was also responsible for collecting the ethnographic data that formed the basis of the article. My co-author, Olli Pyyhtinen, participated in developing the study design, theoretical framework and the conclusions of the article. As the corresponding author, I was responsible for the submission and publication process, which included two rounds of revisions.

Article II: I was responsible for the study's design, collecting part of the data, and writing the analysis and the early version of the manuscript. The ethnographic data utilised in the article were collected by my co-authors Malla Mattila, Elina Närvänen and Nina Mesiranta. As the corresponding author, I was responsible for the submission and publication process, which included two rounds of revisions.

Article III: I played a major role in writing the analysis, and I was responsible for collecting the ethnographic data that formed the basis of the article. My co-author, Olli Pyyhtinen, participated in developing the study's design, theoretical framework and conclusions. He also played a major role in developing the theoretical contribution of the article. As the corresponding author, I was responsible for the submission and publication process, which included one round of revisions.

Article IV: I was the sole author of the study.

1 INTRODUCTION

During recent years, the notion of the circular economy (CE) has gained significant attention in discussions among both practitioners and academics, to the extent that it has become a dominating vision for the transition towards a more sustainable economic system (see, e.g. Calisto Friant et al., 2021). Food waste reduction is a central part of the CE and the CE strategy of the European Union (EU Commission, n.d.). Although the definitions of the CE vary, these definitions often include components such as contrasting the CE with the current unsustainable linear economy, decoupling economic growth from the use of finite resources (Vadén et al., 2020), retaining the value of goods as long as possible (den Hollander et al., 2017) and creating 'sustainable economic growth' (Androniceanu et al., 2021). The most optimistic goals for the CE of the food system are stated as follows: 'A circular economy for food mimics natural systems of regeneration so that waste does not exist, but is instead feedstock for another cycle.' (Ellen MacArthur Foundation, 2017). According to this definition, the goal of the CE of the food system is to design food waste out of the system so that it no longer exists.

However, even in a CE, materials do not circulate into new cycles by themselves; instead, they have to be made to do so. In this dissertation, I analyse the everyday *enactment* of the CE of the food system by focusing on food waste reduction, production and valuation practices in three nodal points of the food consumption process: Finnish supermarkets, households and biogas plants. I, however, not only examine the successful practices of circulating the materials but also show how these practices always entail potential leakages[1] (see also Holmberg and Ideland, 2021), and may complicate the ways in which the CE can be enacted. In doing so, I analyse food waste as a societal phenomenon that is entangled with multiple relations and not merely as a technical or managerial issue. I thus unpack some underlying assumptions related to the possible ways of living with waste in the context of the current discussion on the CE.

[1] With leakages, I refer to potential problems in the practices of dealing with waste in which waste fails to circulate to new cycles or causes potential threats, for example, to the environment (for a more profound consideration on leakages, see Olofsson (2023)).

Similar to several other EU countries, Finland has a strategic programme to promote the CE. It is notable that, in the programme, it is stated, among other things, that the CE 'will renew the structures and operating models of society' (Finnish Ministry of the Environment, n.d. a). Regardless of these rather ambitious goals to renew the way society operates, sociological research on the CE is still scarce. It is largely unclear what kind of societal changes a transition towards a CE will require (Jaeger-Erben et al., 2021) and how, for example, consumers will adapt the practices that are essential for the CE to operate (Hobson et al., 2021). In addition, the CE has been critiqued from various angles (see Corvellec et al., 2022). For example, researchers have argued that the current conceptualisations of the CE are mainly based on capitalist economic growth narratives that do not question current material throughputs (Genovese & Pansera, 2020; Hobson & Lynch, 2016). Scholars have also pointed out that it is unclear how the CE will interact with everyday practices and conventions (Hobson, 2020), that even natural systems do not entail perfect circles (Skene, 2018) and that the CE discourse mainly emphasises managerial and technical issues, thus leaving the social dimension of CE without much attention (Hobson, 2016; Schulz et al., 2019). In line with these notions and extending them, in this dissertation, I argue that there is no CE without the practices that always enact both waste and the CE differently depending on the situation and that the everyday practices of circulating and reducing food waste do not offer complete mastery over waste matter.

The dissertation at hand is a sociological study on the CE of food waste, and it is positioned at the intersection of social scientific waste studies and research on CE. Although waste may not be considered the most traditional research topic for social scientists in general and sociologists in particular, during the past decades, social scientific waste studies have started to develop as a separate research field (see, e.g. Hawkins, 2006; Moore, 2012; O'Brien, 1999). It is important to form a sociological understanding of the practices of disposing, circulating and handling waste, since these practices are inseparably interconnected to the processes of production and consumption. Waste also organises different social and material relations in society by participating in and creating different types of social, moral and economic orders. Waste scholars have analysed how people share their everyday lives with waste (Hawkins, 2006; Valkonen et al., 2019), how different economic and societal processes can be understood by following different streams of waste (Gregson et al., 2015) and through what kind of macro-theoretical frameworks the waste–society relationship can be understood (Gille, 2010), among other things. Although food waste is the focus of this study—it serves as a lens through which the CE and

practices related to waste are observed—the objective of this research is to contribute to social scientific discussions on the CE and waste in a more general way.

In the EU, Finland is one of the top waste generators; however, simultaneously, the country aims to become a zero-waste society. In 2020, Finnish municipalities produced 3.3 million tonnes of waste, which corresponds to 596 kg of waste per inhabitant (OSF, 2021); the EU's average waste generation is 505 kg per inhabitant (Eurostat, 2022). It is clear that the total amount of waste must be reduced, and many different societal actors and stakeholders have been harnessed to solve the waste problem: scientists, businesses, ministries, municipalities, consumers and third sector agents, to name a few. Food waste is a type of waste that has gained a lot of attention both globally and nationally, mainly because food production has a significant impact on climate and biodiversity (Silvennoinen, 2021) and wasting food thus creates unnecessary emissions and leads to loss of resources.

There are multiple definitions of food waste. In this research, food waste broadly refers to food losses and waste (see also Närvänen et al., 2019). This can mean, for example, edible food that is disposed in households or food losses created by the food industry. According to the Food and Agriculture Organization of the United Nations (2011), one-third of produced food ends up as waste globally every year. In Finland, 360 million kg of food waste is produced every year, and most of this waste is generated in households (Luke, 2021). Food waste has gained a lot of public attention in Finland, especially after the Finnish Institute for Agriculture and Forestry started investigating the subject at the turn of the 2010's (Raippalinna, 2019). In addition, the Natural Resources Institute Finland (Luke) has widely researched the topic (see, e.g. Silvennoinen et al., 2019). Various national campaigns have also been launched to tackle consumer and retail food waste, such as Hävikkiviikko (Food Waste Week Finland) and Rakasta joka murua (Love Each Bit, (own translation)).

One reason why I have chosen food waste as the focal point of this dissertation is the notable public attention it has gained both globally and nationally. However, there is also more to it than just the popularity and public visibility of the topic. Food waste is an especially interesting type of waste because of the particular affective and moral undertones related to wasting food and avoiding food waste. Our relationship to food is intimate, since food quite literally becomes part of our bodies when we eat it; thus, we always have to consider situationally whether the food we source is suitable for eating or not. Food (waste) is entangled with problems concerning safety (Abrahamsson, 2019), taking care of family relations (Cappellini & Parsons, 2013) and different ways of caring for waste itself (Article III; Koskinen et al., 2018), to

name a few. In addition, food waste is a moral, environmental and economic concern. It is a moral concern in the sense that not all people have enough food, whereas others have it so much that they are capable of wasting it. It is an environmental concern because it causes considerable loss of resources, such as energy, land and water. Lastly, the economic concerns regarding food waste result from the economic inefficiencies it causes for all actors in the food chain. In this study, I will address in one way or another all these dimensions of the food waste problem. I will, however, also show how these issues are sometimes more contradictory, as one would assume at first glance—for example, wasting food is not considered economically inefficient on all occasions, and sometimes producing food waste is an intrinsic part of moral behaviour. Owing to such tensions and potential contradictions, the CE of food waste is an interesting topic for sociological enquiry.

This study is an article-based dissertation comprising four individually published articles. Each article forms a consistent whole in itself, and the results of each article are valuable. Furthermore, the articles also make a joint contribution. Together, they contribute to a sociological understanding of food waste and the CE by following how food waste and the CE are enacted in various ways in supermarkets, homes and, eventually, in biogas plants. Accordingly, they reveal the different ways of relating to and dealing with food waste in different parts of the food system (Articles I, II and III). They also show how multiple different potential CE futures based on different rationalities are enacted in food waste practices across the food chain (Article IV).

The four articles of the dissertation draw from and contribute to several different theoretical discussions, and it is not possible to cover in detail all of them in this integrative chapter. All articles draw from a *practice-based* approach (this approach is presented in more detail in Chapter 4). Most importantly, the articles lean to praxeological methodology (Mol, 2002), the field of practice theory (see, e.g. Article II; Article IV; Reckwitz, 2002; Schatzki, 2002) and pragmatist tradition in valuation studies (see, e.g. Article I; Article III; Dewey, 1939; Helgesson & Muniesa, 2013; Muniesa, 2012). For me, this kind of focus on practices means an approach to scientific research in which dichotomies between theoretical knowledge and practical action are questioned and in which practices are not seen as separate from understanding or knowing (Popa et al., 2015). It also means an orientation to objects that implies that there are multiple possible realities for them, and these realities depend on the ways in which they are enacted in practices (Mol, 2002). For example, a box of grapes turns into waste if we decide to discard it because of a couple of mouldy grapes in it; however, if we just remove spoiled grapes, it turns into edible food again.

The practice-based approach in this research also means that I consider the CE a system that is constantly made in everyday practices in different parts of society, and different human and more-than-human actors participate in this process. Antti Silvast and Mikko Virtanen (2019) state that 'infrastructure is constantly made, but at the same time, it is – as a resistant and lively socio-material assemblage – part of this making process. The infrastructure is enacted on multiple sites in specific multiple practices' (p. 464). The CE and the infrastructures related to it cannot operate without competent people who reduce, sort and handle the waste in households, retail stores and biogas plants as well as in other sites too, or without the materials and infrastructures that participate in and affect this process. Therefore, I want to make it visible in my research that waste management (technology) in the context of the CE is not only a matter of technology, innovation and engineering (Gregson & Crang, 2010) but it is also about very mundane and ordinary practices to which we all contribute in one way or another in our everyday lives.

This dissertation comprises a multi-sited ethnography of food waste practices at three different sites. In more detail, the research data comprise four weeks of ethnographic observation in a supermarket, 26 food waste diaries collected from Finnish households, observations from four leftover cooking workshops organised together with the Finnish Martha Organization[2] and the Wastebusters research group[3], three weeks of ethnographic observation at two biogas plants and 11 interviews with CEOs, managers and experts working in the biogas sector. The data were collected between 2018 and 2021. The main research question of this thesis is as follows:

How do everyday practices contribute to enacting and complicating both food waste and the circular economy, and how does food waste itself participate in forming these practices?

The articles of this dissertation have their own separate research questions that further open up the practices in each field of this research and focus with different emphases on the themes related to ethics, valuation and futures of food waste:

[2] The Finnish Martha Organisation promotes education regarding home economics (for a more detailed description, see Article II).

[3] Wastebusters research group is located at Tampere University Department of Management and Business. The group focuses on examining food waste and the circular economy, among other things.

How are food products framed and valued in the process of ridding, and how do these practices enact different realities for the products? (Article I)

How is ethical subjectivity constituted for reducing food waste in the context of the circular economy? (Article II)

Through what kind of concrete, hands-on valuation practices may biowaste turn into an asset in everyday operations of biogas plants, and how does waste participate in or complicate these practices? (Article III)

How do different dimensions of the transformativity of practices enact different ontologies for food waste, and how do these ontologies shape the potential CE futures? (Article IV)

Articles I–IV follow the journey that food (waste) undergoes in supermarkets, households and, eventually, in biogas plants. The individual articles together answer the main research question of this dissertation. Articles I–IV highlight, in one way or another, how waste is prevented in the examined environments (answering to the part of the main research question that asks how everyday practices contribute to enacting the CE of food waste), how food waste changes in the practices at different sites and what kind of leakages and disruptions the practices of preventing or valuing waste entail (answering to the part of the main research question that asks how everyday practices contribute to enacting and complicating the CE as well as food waste itself). The last part of the main research question (how does food waste itself participate in forming these practices) is addressed with different emphases in all the articles of this dissertation, but especially in Article III. Article IV draws all the datasets together and analyses how food waste practices enact different realities for food waste and how these realities simultaneously enact the possible CE futures differently.

The structure of the dissertation is as follows. In the following chapters (Chapters 2, 3 and 4), I will present the theoretical and scholarly background of this dissertation. I will first discuss the social scientific waste studies literature, exemplify my approach to waste in this dissertation and position my research in the field of social scientific waste studies (Chapter 2). In Chapter 3, I will consider food waste as a particular type of waste, food waste and the CE and critiques of the CE. Chapter 4 considers the practice-based approach employed in this dissertation and discusses the valuation studies literature, which serves as the theoretical background of Articles I and III. Chapter 5 discusses multi-sited ethnography as a research method and

presents the fields, data collection process, analysis of the data and considerations related to research ethics. In Chapter 6, I will present an overview of the results of the articles in this dissertation. Chapter 7 is the concluding chapter, in which I will discuss the main results, arguments and contributions of this dissertation. I will also present some limitations of this research and provide suggestions for future studies.

2 SOCIAL SCIENTIFIC APPROACH TO WASTE

The aim of this chapter is to provide a background to my approach to waste in this dissertation and position my research within social scientific waste scholarship. I begin this chapter by discussing studies focusing on consumer waste, since social scientific waste studies have, to some extent, stressed analysing consumption practices. First, in Section 2.1, I will contextualise the field of social scientific waste studies, introduce social scientific research focusing on waste in consumer practices and position my research in relation to this line of research. In Section 2.2, I move away from research focusing on consumers and examine research that concentrates on practices related to waste in the retail sector and waste management industry. I will also show how my dissertation relates to this research. In Section 2.3, I position my theoretical and methodological approaches within social scientific waste scholarship. Section 2.4 extends this positioning and discusses the materiality of waste and socio-material practices.

2.1 Waste, consumption and household practices

Waste has remained a rather neglected topic in social scientific research for a long time, apart from the pioneering works of Mary Douglas (1966) and Michael Thompson (1979). In her famous book *Purity and Danger* (1966), Douglas argued that excluding things that are categorised as impure, liminal and thus dangerous is crucial for maintaining social order. In the book, Douglas (1966, p. 41) presents her famous definition of dirt as 'matter out of place'. In Douglas' analysis, dirt is seen as a matter of subjective judgement, and cleaning and ordering are not done primarily to avoid disease but to maintain unity of experience. It is, however, important to note that there are certain issues one must consider when using Douglas' work in analysing waste. Although Douglas' work is often referred to in social scientific research on waste and has been widely utilised in conceptual developments in the field, Douglas does not explicitly write about waste, but her analysis focuses on *dirt*. Moreover, social scientific waste scholars have argued that waste is not simply a result of arbitrary and symbolic classification of things as pure or impure, but it is rather a

sign of the form of life that has produced the waste (Reno, 2014). Max Liboiron (2019) has also highlighted that Douglas specifically says that waste is not at least necessarily 'matter out of place', since there exists a clear and defined place for waste, such as the bin.

Thompson, a student of Douglas, took waste as a topic in his work more explicitly. Thompson approaches waste in the book *Rubbish Theory* (1979) through the idea of the creation and destruction of value. In the book, Thompson develops a division through which things can be separated into three categories based on their value and their potential future development: durable objects, transient objects and rubbish (Thompson, 1979). According to this division, the value of durable objects does not diminish over time, but may even grow. Objects such as vintage furniture belong to this category. Transient objects may have temporal value, but they lose it over time. For example, computers and other utility items can be seen as transient objects. Objects that belong to the category of rubbish are totally worthless. Recently, however, this kind of positioning of waste has been questioned, not least because of the CE efforts of valorising waste (valorising refers to the active production of value; see Vatin, 2013). Several researchers have also pointed out that transient objects, such as food, can move in and out from the category of waste (e.g. Article I; Lehtonen & Pyyhtinen, 2020) and that waste can be valuable in itself (e.g. Abrahamsson, 2019; Greeson, 2020; Gregson & Crang, 2015).

Thompson and Douglas both analysed waste through a social constructionist approach. Rather than exploring how waste comes into being or is enacted and evaluated in material terms, they examine the symbolic, cultural and cognitive judgements related to categorising certain things as waste. However, more recently, social scientific analyses of waste have become more diversified in their approach. During the last 20 years or so, social scientists, including sociologists, have started to become more and more interested in the subject and have analysed it from multiple perspectives. There is so much social scientific research on waste that it is not convenient to list them all here, but researchers have, for example, explored the performativity of waste (Hawkins, 2012), focused on the vitality of waste matter (Gregson & Crang, 2010), analysed the politics of value and waste (Reno 2009) and criticised the idea of a 'throwaway society' (Evans, 2012a).

In contemporary consumer culture, waste is inseparably entangled with the processes of consumption and production. In the book *Waste and Want* (1999), Susan Strasser examines the social history of waste, especially in the North American context. In the book, Strasser shows how disposable products started to replace reusable ones, mainly during the 20th century. In advertising and education,

disposability was associated with hygiene, for example, when promoting disposable sanitary products and plastic packaging around food items. Partly simultaneously, towns and cities took responsibility for collecting and disposing of household waste, which made it easier for people to throw more and more things away.

This development, however, did not happen at once in all parts of the world and in all population groups—for a long time, people living in the countryside or poor families in the cities consumed differently compared with middle-class people in metropolises (Strasser, 1999). Still, this development eventually led to the formation of a so-called consumerist society in which the ability to replace old things with new ones became a central status signal (Valkonen et al., 2019). However, in a consumerist society, disposability no longer means only disposable hygiene products or plastic wrappings—it also refers to the easy replaceability of other products, such as clothes, electronic devices and toys. Waste is an intrinsic part of the process where things get disposed of and replaced, and the current volumes of consumption would not be possible without institutionalised waste management infrastructures that enable people to easily get rid of their waste without thinking about it too much (Hawkins, 2006; Valkonen et al., 2019). As a result of the entangled nature of consumption and waste, some waste scholars have even suggested that instead of speaking about a 'consumerist society', people should rather speak about a 'rubbish society' (O'Brien, 2011).

However, during the last few decades, the practices of recycling and circulating waste have started to alter our ways of living with and speaking about waste. Waste is no longer something that can be just dumped to one single bin and then taken to a landfill by a garbage truck. Now it has to be washed, stored and transported to the appropriate recycling container. Citizens also constantly have to learn new rules related to waste: which items can be placed into a certain bin, what one has to do to waste items before disposing of them and what kind of waste containers one should get to their yard. In addition to treating our waste correctly, we should also learn new ways of consuming and reducing waste in the first place. Researchers have illustrated this with the idea of consumption work (Hobson et al., 2021), a concept that refers to the work that purchasing, using, reusing and disposing of goods requires in the context of the CE. Resulting from all the effort and attention it requires, waste management and waste reduction are currently a central part of our everyday lives and not something that we could completely close our eyes on. Waste and efforts to eliminate it are a crucial part of today's society; thus, waste is an important topic for sociological enquiry.

Although contemporary consumer culture is, in many ways, problematic from the viewpoint of environmental sustainability, consumers still cannot be straightforwardly blamed for being completely reckless. For example, researchers have highlighted that, although people throw food away, they still often do not approach food waste production indifferently (Evans, 2012a). Thus, moralising arguments about wasteful consumers tend to simplify the waste problem, as researchers approaching household food waste from the practice theoretical viewpoint have argued (Evans, 2012a; Southerton & Yates, 2014). For example, waste scholars have significantly contributed to the scholarly discussion on consumer waste by highlighting that food waste production is not simply 'immoral' behaviour. Rather, food waste production may sometimes result from ethically significant practices, such as taking care of family members, as I show together with my co-authors in Article II. In analysing household food waste in Article II, we have paid specific attention to how ethical subjectivity is constituted in relation to food waste and how the ethical goals and practices of reducing food waste may sometimes clash with the persistent routines that delimit the aims of transforming the practices into more sustainable ones. In examining ethical subjectivity, we draw from Michel Foucault's (1994) idea of the arts of existence that Gay Hawkins (2001; 2006) utilised in her well-known analysis of practices of ordering waste in everyday life. Most importantly, Hawkins (2001, p. 5) argued that 'a changing relation to waste is a changing relation to self'. This means that the ways in which we live with our waste constitute our ethical self. My research on consumer practices related to food waste in Article II contributes to previous practice theoretical research focusing on household food waste, especially by grasping the dynamics between the ethical work of transforming practices towards sustainability and other dimensions of practices that may delimit this transformation. In the following section, I will discuss how waste has been approached in research focusing on the retail sector and waste management industry and highlight how my study relates to this research.

2.2 Research concerning (food) waste in the retail sector and waste management industry

The research that I have presented in this chapter so far has mainly focused on consumers and their practices. In particular, empirical social scientific waste research has focused strongly on consumers (Gille, 2010), although not completely exclusively. This may result partly from the fact that accessing businesses can be

harder than analysing consumer practices. In some cases, companies can be concerned about the potential negative publicity, and they may not be willing to let researchers observe their waste production or waste treatment practices. One reason for the strong focus on consumer practices may also be the fact that consumers have often been blamed for their wasteful and indifferent consumption, and the current discussion on sustainability issues, such as food waste, often strongly highlights consumer practices (see, e.g. Evans, 2011). The current sustainability paradigms have also been criticised by sociologists and other scholars owing to their tendency to over-responsibilise consumers and for creating forms of governance in which problems, such as waste, overconsumption and climate change, are framed as problems arising from individual human behaviour (Evans & Mylan, 2019; Evans, 2012a; Shove, 2010). To form a more holistic view of these issues, it is thus important to gain knowledge about the situated practices of dealing with food waste in different sectors. This dissertation does not focus only on consumer practices of producing and reducing food waste but also on retailer practices of managing food waste as well as biowaste treatment in biogas plants. The roles of consumers, retailers and biogas producers in the value chain are very different. Thus, the most important contribution of this approach to the field of social scientific waste studies is that it enables following the changing ways of relating to food waste along the final stages of the food chain.

Although there is some research on retail food waste that focuses on food waste as a managerial problem (Filimonau & Gherbin, 2018; Moser, 2019; Teller et al., 2018), social scientific waste scholars have not widely focused on retail waste. Overall, most of the research on retail (food) waste is rather solution-focused and has aimed to map the root causes of food waste (Mena et al., 2014; Teller et al., 2018), analyse possibilities for reducing it (Thyberg & Tonjes, 2016; Wikström et al., 2019) and quantify food waste (Hartikainen et al., 2019; Parfitt et al., 2010)[4] (I present the studies concerning retail food waste in more detail in Section 3.1). The knowledge that my dissertation produces about retail food waste is rather different: it focuses on the ways in which food waste is framed and valued in the practices of reducing and producing it, and how these framings and valuations situationally produce different realities for food waste. When collecting and analysing ethnographic data from the supermarket, I did not approach retail food waste normatively as a problem that needs to be reduced; I have rather been interested in the ways store employees make sense of producing and reducing food waste when performing their daily practices in the store.

[4] For exceptions, see Swaffield et al. (2018) and Welch et al. (2021).

However, food waste practices extend beyond food waste management within stores and food waste reduction in households. Both retailers and consumers are responsible for recycling the food waste they produce, and in Finland, this waste ends up in composting or biogas plants. Social scientific waste scholars have not examined the waste management industry, such as biogas production, to the same extent as consumer practices; however, there is still some research conducted on the topic. In his research on electronic waste recycling, Stefan Laser (2020) analyses the ways of separating valuable 'scrap' from useless 'waste' in a high-tech recycling and smelting company. He highlights that in the process of valuing and recycling e-waste, only a limited number of materials are actually recycled and new waste is constantly produced. Interestingly, in their research on biogas production in Sweden, Tora Holmberg and Malin Ideland (2021) found that there are similar issues at play at biogas plants as well–the practices of cleaning and sorting at the plants always produce new waste. In addition, their research complicates the straightforwardness of the CE discourse by pointing out that there are multiple leaks and disruptions in the process of turning biowaste into energy. Further, by analysing the case of 'Biovakka', a pioneering Finnish biogas company, Maria Åkerman, Niko Humalisto and Samuli Pitzen (2020) have elucidated how the operations of a biogas plant as a CE business model may clash with the logic of the surrounding linear economy. In doing so, their research highlights the difficulties of turning pig manure into a value-adding substance. Moreover, Joshua Reno (2009) examined the practices of creating value from waste in a landfill. In his research, he pointed out that the employees of the landfill and the landfill company sometimes value waste in competing ways: some of the employees may occasionally either spontaneously or more systematically scavenge and revalue individual objects in the landfill, whereas the landfill company aims for rationalised action in which the objects are turned into a mass that is as homogenous as possible.

My observations in the biogas plants hold many similarities to all these studies. The practices of creating value from biowaste constantly produce new waste, such as plastic packages and rejected batches of biowaste; thus, it is crucial for biogas plants to turn biowaste into mass that is as homogenous as possible, and creating value from biowaste is anything but easy and straightforward (Article III). Although both Laser (2020) and Reno (2009) have utilised ethnographic methods in their research, Holmberg and Ideland (2021) mainly rely on interview data in their analysis, and Åkerman, Humalisto and Pitzen (2020) have also mostly utilised interview material in their examination. My fieldwork in biogas plants thus produces interesting empirical material concerning biogas production in Finland, since only a

few previous ethnographies have observed hands-on practices at biogas plants. In the following section, I will position my approach to waste in this dissertation theoretically and methodologically within social scientific waste scholarship.

2.3 Positioning the research

In the previous sections, I presented the most relevant research from the viewpoint of this dissertation and highlighted how it relates to these studies. In this section, I position my theoretical and methodological approach to waste within the field of social scientific waste studies. A review article by Sarah Moore (2012) presents a broad and comprehensive view on the ways in which waste scholars have analysed waste, and I will utilise the article in this section to position my research. Using the article as a starting point for explaining my approach is useful for two reasons: First, as the article is well-known and much cited, using the paper as my point of reference will make it easier to concisely explain my approach to scholars in the field of social scientific waste studies. Second, as the article gives a comprehensive view on the field of social scientific waste studies, it is useful for explaining different approaches in the field to readers who are not that familiar with social scientific waste research. It is, however, important to note that Moore's article was published a decade ago. At that time, social scientific waste studies was only starting to develop as a separate research field. Research in this field has multiplied during the past decade, and Moore's article illustrates the conceptual multiplicity in social scientific waste studies, which started developing as an independent field of study at the time. Although Moore's grouping of studies is slightly unclear and, to some extent, simplifying at some points, as I will briefly reflect later in this section, the article is still useful in positioning my own research.

Moore has created a figure that categorises different approaches in social scientific waste studies into four sections. The sections are divided based on two axes, one of which is vertical and the other is horizontal. The left side of the horizontal axis describes research that approaches waste through positivity, which means that it assumes some specific character for waste, whereas the right side of the horizontal axis applies to studies that view waste negatively. This means that they do not assume that waste has any intrinsic features. The vertical axis then describes

whether the studies approach waste through a dualist or relational approach [5]. In the dualist approach (on the top of the axis), waste is seen as a separate entity from society, whereas the relational perspective sees waste and society as related to each other (bottom of the axis). It is, however, important to note that researchers may often employ more than one framework in their work (Moore, 2012), and sometimes, several frameworks can be applied even in one particular research output. Thus, the 'classifications' made here are not completely absolute, but they are still helpful in mapping the research field of social scientific waste studies as a whole.

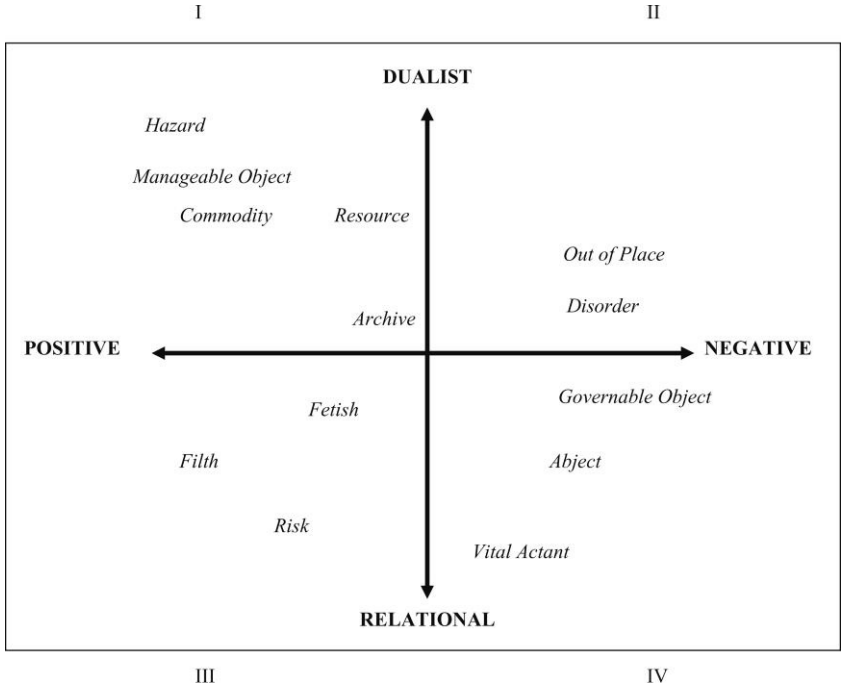

Figure 1. Note. This figure was produced by Moore in 2012, summarising the different approaches to waste in social scientific waste scholarship. From 'Garbage matters: Concepts in new geographies of waste' by S. A. Moore, 2012, *Progress in Human Geography*, 36(6), p. 782 (https://doi.org/10.1177/0309132512437077). Copyright 2012 by Sarah A. Moore. Reprinted with permission.

Studies that approach waste in a positive and dualist manner (Quadrant I) see waste as external to society and conceptualise waste as a hazard, manageable object, commodity, resource and archive (Moore, 2012). In these conceptualisations, waste

[5] It is, however, crucial to note that Moore's 'relational'/'dualist' dichotomy is rather problematic, as waste can simultaneously be relational (constituted in different societal relations) and disrupt governance and society, thus appearing as 'dualist'.

is seen as something that has strong defining characteristics and is largely external from society. Research that approaches waste as a hazard often focuses on the exclusion of hazardous waste materials, such as human and animal waste, uneven development and unfair distribution of environmentally and sanitarily hazardous material (see, e.g. Davis & Garb, 2019; Okafor-Yarwood & Adewumi, 2020). Further, research that sees waste as a resource often concentrates on formal or informal practices of recycling and recovering materials by re-entering them into the formal or informal cycles of economic production (Åkerman, 2020; Reno, 2009; Valkonen et al., 2017). Studies that conceptualise waste as a commodity may, for example, analyse the processes of trading waste between nations. This research has examined waste as a commodity with market value (Gregson et al., 2013). Enquiries analysing waste as a manageable object have examined, for example, municipal waste management (Lougheed et al., 2016) and regulations concerning waste (Deutz, 2009). Finally, when waste is approached as an archive, it is seen as a source of knowledge about the current practices of production, consumption and waste management. Studies approaching waste as an archive have examined waste as an object that gives us information about the form of life that has produced it (Reno, 2014), among other things.

Explorations that analyse waste from a negative and dualist viewpoint (Quadrant II) consider waste a disorder and matter out of place. These approaches also see waste as largely external to society and thus as something that has to be excluded. This category of research includes Douglas' (1966) famous analysis of waste as 'matter out of place', which I have already mentioned in Section 2.1. Several studies on waste in this quadrant draw from this conceptualisation. In addition, some research in this section, also partly leaning to Douglas' analysis, examines waste through the ideas of disorder, order and ordering (Edensor, 2005; Hetherington, 2004). It is, however, important to note that positioning Douglas' analysis to this quadrant is not very straightforward. This results from the fact that Douglas' approach could also be seen as relational instead of dualist since, on the one hand, pure and impure always exist only in relation to each other. On the other hand, the theme of ordering and excluding waste constitutes an approach in which waste is seen as something that needs to be excluded from society to maintain order. Thus, as I already pointed out previously, a particular study can sometimes potentially fit into several frameworks, depending on the viewpoint.

Studies that understand waste in a positive and relational manner (Quadrant III) conceptualise waste as risk, filth and fetish. This research sees waste as related to society and emphasises the filthy and disgusting features of waste. Researchers have,

for example, examined the affective capability of waste to provoke action and the need to remove it (Hawkins, 2006). Approaching waste as a risk has some similarities to analysing waste as a hazard, but the most notable difference between these viewpoints is that, when waste is considered a risk, it is seen as more related to society. Researchers who have studied waste as a risk have, for example, analysed waste as a hardly controllable actor (Gabrys, 2009; Liboiron, 2016). Further, research that analyses waste as fetish sees it as an object with use and exchange value. Studies approaching waste as fetish have examined household practices of ridding and circulating waste (Gregson et al., 2007), among other things.

Research that approaches waste from a negative and relational viewpoint (Quadrant IV) sees waste as a governable object and as an abject and vital actant. In this section, waste is not considered to have any intrinsic characteristics, and it is seen as constitutive of society. Research that has analysed waste as a governable object has examined waste, for example, as constitutive of socio-material relations and governance. This research includes, among other things, examinations of waste as an object that is both a subject and an intermediary of state power at the same time (Hawkins, 2006; Woolgar & Neyland, 2013). Research that sees waste as an abject has analysed it as an entity that has to be excluded in order to preserve the self as clean (Kristeva, 1982), whereas analyses of waste as a vital actant have argued that waste can act in the networks of human and nonhuman objects (Gregson & Crang, 2010; Hawkins, 2012).

This dissertation is positioned in Quadrant IV of Moore's figure (horizontally right and vertically below). Each article takes a somewhat different approach to waste, but they all still understand waste within this wider framework. In Articles I, II and IV, waste is seen as a rather governable object that is dealt with in socio-material practices, but it is still noted that waste is not always perfectly governable and that it can disrupt governance in some occasions. In contrast, in Article III, waste is more explicitly conceptualised as a vital actant that affects the practices of valuing and governing it. Overall, all the articles in this dissertation consider waste to be related to society and a part of different societal processes by focusing on how waste is dealt with in everyday life in different societal sectors. In the following section, I will describe the approach to waste adopted in this dissertation in more detail by reflecting on the issues related to the materiality of waste and its associated socio-material practices.

2.4 The materiality of waste and socio-material practices

Especially during the past 15 years or so, and after social scientific waste studies has started to develop as a separate research field, waste scholars have started to pay growing attention to the materiality of waste. Simultaneously, interest in materiality has also increased more generally in social scientific research (see also Lehtonen, 2009). Waste scholars interested in materiality have examined the 'thingness' of waste, the ways of living with waste in everyday life and the social and economic processes revealed both through waste and in waste itself (Moore, 2012). Researchers have, for example, analysed how the spatiality and materiality of waste contribute to forming family relations and household practices of discarding waste (Gregson, 2007). In the book *Living with things: Ridding, accommodation, dwelling*, Nicky Gregson (2007) examines how ridding unwanted things is a central practice of inhabiting a home. In other words, Gregson considers the process of getting rid of objects as a central part of being present, living and forming relations at home. Especially Article II of this dissertation discusses how the practices of getting rid of food waste at home may contribute to forming ethical relations in everyday life. Moreover, Article I considers the process of ridding a central aspect of creating value for food products in a supermarket.

Social scientific waste studies have also explored the capability of waste to affect different social and material settings. This has been done, for example, through analysing food packaging (waste) as stuff with performative capabilities (Hawkins, 2012). In her study on the materiality of food packaging, Hawkins (2012) examines how food packaging has become a central element in the organisation of markets — the packaging makes food last longer, enables both keeping it fresh and buying food products to eat 'on the go', and the waste produced as a result of packing food in plastic shapes waste governance practices in many ways. In other words, food packaging has a performative capability to shape the way our everyday lives and consumption practices are organised. Article III of this dissertation discusses how biowaste has a tendency to affect the practices of managing it in biogas plants. However, all the articles of the thesis still, in one way or another, explore how food waste shapes everyday practices.

In addition to Gregson's and Hawkins' studies, social scientific waste scholars focusing on the materiality of waste have examined waste from multiple other perspectives. They have, for example, illustrated how material association to waste stigmatises people working with waste formally (Reno, 2009) and informally (Carenzo & Good, 2016) and affects their personal relations, and focused on the

ordering of the material world by shifting their focus towards the disordering effects of ruination and decay (Edensor, 2005). Moreover, researchers have also examined how social narratives of waste management shape the ways how people engage with waste materials (Corvellec and Hultman, 2012), and explored how the material characteristics of waste affect its' agency (Loboiron, 2016).

In line with the studies mentioned in the previous paragraphs, this dissertation pays special attention to the materiality of waste. This means that I see waste as something more than only a symbolic category that is created as a result of cognitive judgement, in contrast to, for example, Douglas' (1966) and Thompson's (1979) analyses. More specifically, my focus on the materiality of waste is apparent in two ways. First, all the articles in this thesis analyse the ways in which socio-material practices shape waste and produce different realities and ways of being for both waste itself and the practitioners that deal with waste. Second, Article III particularly analyses the performativity of waste, that is, the ways in which waste shapes the practices into which it is entangled. In the next two paragraphs, I will discuss these two dimensions of materiality in more detail.

One central dimension of the materiality of waste is the question of when a certain item or material turns into waste and how socio-material practices contribute to moving things between different categories. Of course, changes in the material composition of, for example, food (moulding or fermentation) affect the ways in which we perceive something as waste or not waste, but this is also at least, to some extent, always relational (see also Van Bemmel & Parizeau, 2020). In other words, people perceive, define and enact waste differently. To methodologically grasp how waste comes to be through practices, I draw from Annemarie Mol's (2002) idea of praxeology: food and waste are always enacted and created through concrete situated actions. This means that objects do not turn into food or waste by themselves but that their different statuses are actively created. For example, food turns into waste when it is moved to the waste container, even if it is technically still edible. People also need to take several actions to keep items in the category of food, such as organising food products and taking care of the cold chain (see Article I). Most importantly, such situatedeness of practices means that there are multiple possible realities for certain objects that are enacted through practices. For example, for some people, shrivelled carrots are not waste, whereas some people do not want to eat them and thus throw them away. These different realities of waste are materially, spatially and practically produced (see also Woolgar & Neyland, 2013), and moving things to different locations and spaces changes the way they are approached. For

example, a biowaste bag in a dining table is a health hazard, but in the recycling bin, it turns into a resource for a CE business that a responsible citizen has recycled.

In addition to focusing on socio-material practices, this dissertation also analyses the performativity of waste, that is, the capability of waste to produce different effects as a part of different assemblages. The articles in this dissertation vary in the degree to which they focus on the performativity of food waste. Articles I, II and IV place stronger emphasis on practices of managing food waste, whereas Article III more profoundly analyses how waste itself affects the practices and possibilities of managing and valuing itself. Previous social scientific waste research has also emphasised the performativity of waste to different degrees. While part of the studies focusing on waste approaches materials and the material environment mainly as something that gives the context for human practices and also possibly steers and delimits the ways in which practices are performed (see, e.g. Article I; Article II; Evans, 2012a; Gregson, 2007), some studies more strongly emphasise waste's capability to actively produce effects (see, e.g. Article III; Gille, 2010; Hawkins, 2012). The analyses that stress the performativity of waste often draw from the field of science and technology studies (STS) and posthumanist scholarship, probably most commonly from actor–network theory (ANT) (Latour, 2005) and assemblage thinking (Deleuze & Guattari, 1987; Pyyhtinen, 2015). This means that socio-material reality is seen as constructed by both human and more-than-human entities that are often both seen as pragmatic and performative. In other words, these studies stress that either human or more-than-human entities are not just passive parts of reality, but they both actively participate in shaping it. In the following chapter, I will position my research in relation to CE research and discuss food waste as a particular type of waste in the context of the CE.

3 FOOD WASTE AND CIRCULAR ECONOMY

In this chapter, I discuss food waste as a particular type of waste in the context of the CE, how research has approached the CE and how the CE has been critiqued. In Section 3.1, I examine the distinct characteristics of food waste in comparison to other types of waste, provide a brief review on how different actors in the food chain approach food waste and consider how the practices of different actors are interconnected. I also write about some of the specificities related to food waste in public discussions in the Finnish context. Section 3.2 focuses on the conceptual definitions of the CE and the EU policies related to tackling food waste as part of the CE transition. In Section 3.3, I examine critiques of the CE.

3.1 What kind of waste is food waste? Distributed responsibility in the food chain

Different wastes have different kinds of material qualities, social statuses, temporalities and values, and their treatment also requires different kinds of actions. Obviously, for example, nuclear waste is very different from textile waste, and these two types of waste probably raise very different feelings and orientations towards them. Research focusing on food waste often approaches (implicitly or explicitly) food waste as a type of waste that is particularly entangled with different kinds of affective relations (Alexander et al., 2013; Waitt & Phillips, 2015). This results from the fact that food often undergoes different material transformations and processes of decay in a relatively short period of time, and these transformations often cause feelings such as disgust or anxiety (Watson & Meah, 2012). Eating is a very intimate practice, and the food that we eat affects our bodies in many ways.

There are plenty of different emotions, relations and moral sensitivities connected to food and practices of disposing of it (Article II; Koskinen et al., 2018). For example, eating the leftovers of others can constitute family membership; parents may eat the discards left from previous meals to provide the family with a fresh meal (Cappellini & Parsons, 2013). In addition, disposing of food is often considered morally contradictory. People may be concerned about the environmental problems

related to food waste (Southerton & Yates, 2014), and the aim of not wasting food can be seen as an important way to pay respect to the work of people who have produced the food and the animals that may have been killed in the process. People may also often think that the fact that a large part of the world's population suffers from hunger makes it inappropriate to waste food carelessly (Article II; Gruber et al., 2016).

The line between food and waste is not always clear, nor are there always possibilities to make completely 'objective' judgements on whether a food item is still edible (Koskinen et al., 2018). Of course, there are institutionalised measures for managing the edibility and safety of food, such as date labels, but even these are not always completely reliable. If the cold chain of the food item is interrupted at some point in the supply chain or the package is damaged, food may spoil faster than expected. Making judgments whether a particular food item is still edible is a rather corporeal and sensory process—we often make these judgments through smelling, tasting and sensing, and a misjudgement may lead, in the worst case, to imbalances in the systems of our body. Thus, when assessing the edibility of food, people often face tension between assuring safety and avoiding waste (Abrahamsson, 2019).

Even though consumers are often blamed for wasting food and lacking competence in preventing food waste (Evans, 2012a), research findings imply that consumers actually feel bad about throwing food away and use several skills to prevent food waste. Cooking from leftovers requires skills and knowledge regarding the material qualities of leftovers as well as the context of their use (Cappellini & Parsons, 2013). Humans alone are not, however, responsible for preventing and producing food waste or for creating conventions concerning different qualities of food. There are also several technological means that affect and stretch the temporalities of food (waste) along the food chain and shape the producer–consumer requirements concerning food products. Mundane and often taken-for-granted technologies, such as refrigerators and freezers (Salonen, 2022), enable people to store food longer, but they also affect the expectations related to food. For example, the patterns of domestic food consumption, such as the expectation that food should be 'fresh', are inseparably tied to the global development and availability of cold chains and refrigeration technologies (Evans & Mylan, 2019; Rinkinen et al., 2019). In their research, Malla Mattila, Nina Mesiranta, Elina Närvänen, Outi Koskinen and Ulla-Maija Sutinen (2019) show how these technologies also participate in the practices of preventing food waste at homes by enabling scheduling, pausing, stretching and synchronizing when preventing food waste: planning in order to prevent food waste emerging at all, freezing food for later use

to save it from spoiling, cooking from food that could potentially end up as waste and taking the different temporalities of food into account to avoid waste.

Much of the research concerning food waste has been conducted in households or is in some other way related to consumer practices, as I already highlighted in the previous chapter. Food waste is, however, produced and treated along the whole food chain: primary production, food industry, catering services and retail stores (the selection of the sites in this dissertation is justified in Section 5.1). There exists some research on retail food waste, as mentioned in the previous chapter, but retail food waste is not as widely researched as household food waste. Researchers have, for example, highlighted that food waste is something that retailers must avoid in order to maintain efficient store operations (Teller et al., 2018). For retailers, food waste is a problem that results from various reasons, such as stock keeping, poor handling of products by store employees, inefficient supply chain processes and transportation, high consumer standards and short shelf-life or sensitivity of products (Stenmarck et al., 2011). Retailers are responsible for securing the safety of the items they sell, which may also affect the amount of waste generated (Holweg et al., 2016). Researchers have also shown that both human and non-human actors participate in the production and reduction of retail food waste (Alhonnoro et al., 2019).

Although retail food waste has often been approached as a managerial problem (Filimonau & Gherbin, 2018; Moser, 2019; Teller et al., 2018), food waste still evokes ethical considerations and different kinds of emotions in people who deal with it in their everyday work. Researchers have pointed out that retail store employees and managers often feel bad about throwing food away since producers have worked hard for it (Moser, 2019). In addition, disposing of food is considered problematic because some people do not have enough to eat (Gruber et al., 2016). This shows that, although food waste is an intrinsic part of the everyday operations of retail businesses, people working in the sector still do not approach the issue indifferently. Thus, food waste often invokes moral considerations in environments other than households. Previous research has also highlighted that retailers often voluntarily contribute to food waste reduction (Welch et al. 2021). There are multiple reasons for the voluntary actions retailers take to reduce food waste: they may consider contributing to food waste reduction as their moral responsibility, food waste may be seen as a financial problem for the business, and reducing food waste can enhance the brand and reputation of the supermarket (Swaffield et al. 2018).

As a result of the moral and environmental concerns related to food waste and the wide publicity the topic has received, food waste has become a central part of the corporate social responsibility (CSR) actions of retail businesses (Devin &

Richards, 2018). Finnish retailers have, for example, set numerical objectives to reduce food waste, they report the amount of food waste annually in their sustainability reports and publicly announce what they do with their food waste and where it ends up if it cannot be prevented (Article I; Mesiranta et al., 2022). Usually, Finnish retailers donate their food waste to food banks, and they can sometimes sell it at a reduced price (PTY, n.d.). If food waste cannot be prevented, it is utilised in biofuel production or, alternatively, in energy production in other ways.

In addition to these actions that retailers have taken to reduce their own food waste, they also campaign for cutting down consumer food waste. In Finland, retailers have aimed to contribute to household food waste reduction through developing mobile applications that help consumers plan their shopping, providing recipes for cooking from leftovers and educating consumers about 'best before' and 'use by dates', among other things (PTY, n.d.). Similar initiatives have also been launched in other countries, such as the UK. In their study that concerns how different actors in the food chain are seen as responsible for food waste production in the UK, Daniel Welch, Joanne Swaffield and David Evans (2021) claimed that the food waste challenge has recently become framed through the idea of shared responsibility, in contrast to the earlier tendency to mainly responsibilise consumers. In their research, Welch, Swaffield and Evans focus especially on the different framings, interpretations and responses to the food waste problem. They highlight that instead of responsibilising individual actors in the food chain, the current discourse on food waste frames the responsibility for food waste production as distributed throughout the consumption–production system. In their research, they show that framing of the food waste problem is currently dominated by the idea of *distributed responsibility*. In this dissertation, I draw from this notion and highlight that food waste cannot be seen only as a problem that results from the actions of some particular actors in the food chain; rather, it results from more complex relations in the consumption–production system.

Overall, it can be said that both retail and consumer food waste have gained notable public attention in Finland and in other countries. Probably most importantly, the large environmental footprint of food waste has affected its publicity in different sectors—it has been estimated that food waste generates 8% of the global total annual anthropogenic greenhouse gas emissions (FAO, 2013). However, there have also been some critical remarks concerning the attention given to food waste in the public discussion in Finland. For example, in September 2021, Finnish writer and food expert Mari Koistinen, who has focused on the sustainability of the food system in her work, published a blog post that argued that the wide focus

on food waste in public discourse leads consumers and political decision makers astray (Koistinen, 2021). In the blog post, Koistinen wrote that instead of the strong promotion and research effort that is directed towards food waste reduction, stronger focus should be put on reducing meat and dairy consumption, since they have significantly larger carbon footprints compared with food waste, and the food that ends up as waste would also have a smaller environmental impact if we would move to plant-based diets. Simultaneously, when there is strong public condemnation of food waste, research has highlighted that reducing meat eating often evokes resistance in people (Oleschuk et al., 2019). Certain moral commitments related to food, as highlighted previously, make people especially concerned about wasting food, but not all sustainability issues related to food are always taken equally seriously.

Regardless of consumers' and retailers' efforts towards reducing food waste, food still ends up as waste. In Finland, the food waste that consumers and retailers have not been able to prevent is either composted or treated in biogas plants. This, however, is obviously dependent on whether the waste is recycled properly—60% of household biowaste is not recycled in Finland and thus ends up incinerated (Finnish Ministry of the Environment and Finnish Ministry of Agriculture and Forestry, 2021). Waste management companies constantly try to educate people to recycle better. Furthermore, in Finland, the new Waste Act mandates that biowaste must be collected separately from all households, including detached houses, starting June 2024 in all urban areas with a minimum of 10,000 residents (Finnish Ministry of the Environment, n.d. b). This act aims to improve the recycling percentage of biowaste. However, in addition to the problems related to poor recycling, waste management companies have to deal with the contaminants that biowaste includes. A large quantity of biowaste arriving at biogas plants is packed in plastic since retailers do not remove the packaging from food products when they throw them away. Moreover, households often pack their biowaste in biodegradable plastic bags. Therefore, biogas plants need to have specific machinery for removing packaging from biowaste, and the treatment of side streams, such as plastic packages, imposes additional costs on biogas businesses. In this sense, household and retail waste treatment practices directly affect the operation and practices of biogas plants.

In addition to educating consumers about sorting their waste properly, municipal waste management companies, in particular, try to steer consumers to reduce their food waste in the first place. Many of these companies have, for example, participated in the annual Food Waste Week Finland (Hävikkiviikko). Thus, not only retailers but also waste management companies have played a role in tackling

consumer food waste through campaigns on food waste reduction. However, researchers have also pointed out that many actors that participate in public discussion concerning food waste reduction often seem to highlight their own accomplishments and efforts in food waste reduction, while their actions may still in some situations lead to increased amounts of food waste in other parts of the food chain (Sutinen & Närvänen, 2022). Overall, in the food system and especially in the context of the CE, different actors, such as consumers, retailers and waste management companies, are interconnected and affect each other's practices, as the discussion in this section illustrates. The CE, and in relation to this, especially the EU food waste hierarchy, has become a key guiding principle related to food waste reduction across the food chain. In the next section, I discuss food waste and the EU food waste hierarchy in the context of the CE transition in more detail.

3.2 The circular economy and food waste

The CE is often viewed as an important approach for sustainable environmental and economic development (Korhonen et al., 2018); however, a commonly accepted definition for the CE is still lacking (Merli et al., 2018). For example, Fenna Blomsma and Geraldine Brennan (2017) conceptualise the CE as an umbrella concept. This means that the CE can be seen as a rather broad and loose idea that encompasses and 'accounts for a set of diverse phenomena' (Hirsch & Levin, 1999, p. 200). Scholars have critically confronted the lack of a proper scientific definition for the CE concept and have criticised the fact that CE definitions and approaches have so far been largely developed by policy and business practitioners, such as the EU or Ellen McArthur Foundation (Korhonen et al., 2018) (the critique related to the vagueness of the CE concept will be more widely discussed in the following section). The definitions of the CE in academic literature often consider aspects such as closing material loops as well as reducing, reusing and recycling materials. For example, one much-cited definition of the CE reads as follows: the CE is 'a regenerative system in which resource input and waste, emission and energy leakage are minimised by slowing, closing, and narrowing material and energy loops. This can be achieved through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling' (Geissdoerfer et al., 2017, p. 759). However, typically, the definitions of the CE do not pay much attention to materials that cannot stay in circulation for a long time (e.g. referring to long-lasting design), such as food waste. In this dissertation, however, I do not consider it expedient to

stick to any of the various definitions provided for the CE in scientific or practitioner literature. Rather, I approach the CE in practical terms, as a system that is constantly enacted and sustained in concrete hands-on practices that make materials circulate and contribute to keeping them in circulation (Article III; Article IV; Holmberg & Ideland, 2021).

This dissertation examines the CE transition of the food system by focusing on practices related to food waste. Halving food waste at the consumer and retail levels is part of the EU CE strategy (EU Commission, n.d.). Food waste is one of the most central issues affecting the sustainability of the food system (Luke, 2019). Food waste has been conceptualised as a wicked problem (Närvänen et al., 2019)—it is unstructured, cross-cutting and relentless (Weber & Khademian, 2008; for more on the study of wicked problems in sociology, see Selg et al., 2022). It is unstructured in the sense that it lacks a commonly shared definition, and its causes and effects are challenging to identify (Närvänen, et al. 2019). In addition, food waste also involves many stakeholders in the food system—from farmers to consumers—and thus is a cross-cutting issue. The relentlessness of the food waste problem becomes apparent in the difficulties of solving it—it cannot be 'solved once and for all' (Närvänen et al., 2019, p. 5). In this dissertation, the wickedness of the food waste problem is addressed especially by highlighting potential obstacles of reducing food waste and turning everyday practices circular at the different sites of this study.

A large amount of food waste in the so-called Western countries is produced at the end part of the food chain, for example, by consumers, restaurants and retailers (FAO, 2011). According to the current estimations in Finland, households produce 33% and retail stores 16% of the annual total amount of food waste emerging in the whole food chain (Riipi et al., 2021). The EU has taken several actions to tackle food waste, and the EU CE policy is guided by the so-called food waste hierarchy (EU Commission, 2020; Papargyropoulou et al., 2014). The aim of the food waste hierarchy is to guide the utilisation and prevention of food waste in order to achieve the best results from the viewpoint of material efficiency. The most preferable option that is placed on top of the hierarchy is waste prevention, which means preventing waste at the source throughout the whole supply chain. The second preferable solution is to re-use food for human consumption, for example, by distributing food through food banks and if this is not possible, re-using it for animal feed. After these measures, the next preferable option is to reuse and recycle, that is, revalorise food waste into value-added products, such as biogas. After this comes recycling to recover nutrients, which means composting the waste or using the digestate from anaerobic digestion as a fertiliser. If this is not possible, the next

option is the recovery of food waste, which means using the waste in energy production, for example, through incineration. The final and least preferable option is disposal, which usually means sending waste to a landfill.

Scholars have, however, pointed out that current waste prevention efforts often focus on managing the existing waste through recycling and recovery rather than preventing waste at the source; further, the food waste management measures suggested in the hierarchy often actually compete with each other (Mourad, 2016). In practice, this means that solutions that are economically most appealing, such as producing biogas from biowaste, may be prioritised over waste prevention. Such issues usually result from the fact that preventing waste would require more profound changes in the food system that address the root causes of food waste, such as oversupply. Because of such issues, one may ask if the CE's so-called 'from waste to resource' paradigm really encourages addressing the root causes of waste production and, thus, solutions that would lead to more sustainable production and consumption practices. The next section will address this question, among other things, by focusing on research that has criticised CE policies and visions from multiple perspectives. It will also highlight the specific ways in which this dissertation problematises the CE.

3.3 Critiques of the circular economy

The CE has become a guiding vision behind the EU's aims of creating sustainable economic growth. In addition to the goals of reducing the use of virgin raw materials and decoupling economic action from the use of finite resources, the CE aims to increase the EU's competitiveness and create new jobs (EU Commission, n.d.). Researchers have, however, shown that the CE is a contested paradigm with competing interpretations that focus on varying degrees of social, ecological and political transformation (Calisto Friant et al., 2021). In their research on EU CE policies, Martin Calisto Friant, Walter J.V. Vermeulen and Roberta Salomone (2021) identified different core EU CE discourses through an analysis of EU CE communications, regulations and directives. In brief, their analysis indicates that the EU CE discourse is highly optimistic and that it 'did not challenge modernist worldviews and systemic socio-cultural structures' (Calisto Friant et al., 2021, p. 342), even though many researchers consider these issues to be central elements of the current social and ecological sustainability crisis (Beling et al., 2018; D'Alisa et al., 2014; Genovese & Pansera, 2020).

The idea of decoupling economic growth from 'environmental bads', which is at the core of EU CE policy, has also been problematised. Scholars have pointed out that while there is some research evidence on the possibility of decoupling land and blue water use from GDP on the national level, there is no empirical evidence on the possibilities of fast and continuous economy-wide resource decoupling on a global scale that reaching sustainability goals would require (Vadén et al., 2020). Consequently, the notion of decoupling has been claimed to be empirically weakly founded, thus resting partly on faith. Researchers have raised concerns that this kind of high optimism towards decoupling as a central pathway to a more sustainable economic system without empirical evidence about the possibilities of putting it into practice is seriously risky in a situation where our societies are faced with an existential threat (Vadén et al., 2019).

Apart from the issues related to decoupling, the notion of the CE and circular business models have also received criticism in the academic literature from multiple other perspectives. In their review article on critiques of the CE, Hervé Corvellec, Alison F. Stowell and Nils Johansson (2022) identify different viewpoints in this criticism. First, they refer to the 'definitional quagmire' of the CE: researchers have, for example, argued that the definition of CE is deliberately vague in order to enable the promotion of an ostensibly consensual win-win policy (Lazarevic & Valve, 2017). They also highlight that CE critics have noted that the CE neglects a lot of existing knowledge, such as the thermodynamic law that matter cannot be destroyed (Giampietro & Funtowicz, 2020), and the fact that new waste streams that cannot be circulated are emerging all the time (Mavropoulos & Nilsen, 2020). The article also addresses the critique focusing on the unclear implementability of the CE, as well as its uncertain contribution to environmental and social sustainability. The practical implementation of CE at the level of policy, organisations and individual consumers is still limited, and as a response to current sustainability challenges, it has been claimed to underestimate these challenges in the first place (Corvellec et al., 2022). This is because the idea of the CE is based on a rather small fraction of wastes in the global throughput (Åkerman et al., 2020), among other things. In the existing critiques of the CE, the metaphor of 'circle' has also been problematised because of its elusiveness (Corvellec et al., 2020), and it has been highlighted that the CE is a corporate-led model that is mainly based on the trust of the markets rather than disrupting the status quo, thus obfuscating the problems of waste accumulation and resource scarcity (Corvellec et al., 2022). The technocratic representation of the CE has also been criticised for depoliticising policy and industry interventions (Niskanen

et al., 2020), and it has been pointed out that the CE frames continuous consumption as an unproblematic activity, since 'waste will be recycled' (Corvellec et al., 2022).

Some recent critiques of the CE have especially underlined the issues related to making the CE 'actionable' (Hobson et al., 2021) and argued that the socio-cultural change that the transition towards a CE requires is often left without much attention (Hobson, 2016). In my study, I approach and problematise the CE by focusing on the possibilities and difficulties of making waste circular in everyday practices in the researched environments. In more detail, I focus on the making of the CE in practice (Holmberg & Ideland, 2021) and explore how the practices succeed and fail in preventing waste and circulating it. The articles examine this issue from four different perspectives: the clashes between different modes of valuing that lead to leakages and disruptions in waste prevention in supermarkets (Article I), the ethical complexity of everyday life and contradictions between different ethical obligations in households that complicate food waste reduction (Article II), the impossibility of completely managing waste and difficulties of turning biogas and biofertilisers as assets in biogas plants (Article III) and the different realities produced for food waste in practices that simultaneously enact possible CE futures differently as well as how these practices may not always create futures in which waste is reduced (Article IV). In the following chapter, I will discuss the practice theory and valuation studies from which the articles of this dissertation draw when focusing on the everyday enactment of the CE.

4 PRACTICE-BASED APPROACH AND VALUATION STUDIES

In this chapter, I discuss the theoretical and methodological foundations that are common to all the articles in this thesis. In Section 4.1, I exemplify what I mean by practice-based approach in this dissertation. I will first discuss the tradition of practice theoretical research and its historical background. Then, I examine Mol's (2002) praxeological methodology. Section 4.2 discusses socio-material practices in the context of valuation. In the final section of this chapter (4.3), I provide a brief summary on the theoretical framework of this dissertation that has been outlined in Chapters 2, 3 and 4.

4.1 Practice-based approach, practice theory and praxeology

All the articles of this thesis adopt a practice-based viewpoint on food waste and the related everyday activities. By practice-based approach, I do not refer only to the tradition of practice theoretical research (e.g. Reckwitz, 2002; Schatzki, 2002; Shove et al., 2012) but also to a wider family of research that focuses on practices (Hui et al., 2016). This research entails, for example, examinations of situated actions and behaviours (Gherardi, 2008), praxeological methodology (Mol, 2002) and pragmatic and practice-focused approaches in STS more generally (Asdal, 2018). A practice-based approach makes it possible to analyse how the CE of food waste is enacted in concrete everyday activities in different sectors of the food system. Moreover, this approach enables examining the socio-materiality (Gherardi, 2016) of food waste-related actions and taking more-than-human entities and their capabilities to affect the practices into account. However, the articles in this study vary in the degree of performative capabilities that they assume for food waste, as I discussed in Section 2.4.

While Article II contributes directly to practice theoretical research, Articles I, III and IV rather apply a wider practice-based approach. Articles I and III also lean on discussions in valuation studies that draw from the pragmatist tradition (valuation practices and valuation studies are discussed in more detail in Section 4.2). In

sociological publicity, Pierre Bourdieu's (1977) and Anthony Giddens' (1984) developments of practice theory in the 70s and 80s were ground-breaking. Their approach to practices is, however, rooted in American pragmatism (see, e.g. Dewey, 1939), which has a more than 100-year-old tradition. In addition, in the 90s, Luc Boltanski's and Laurent Thévenot's (1991) work on the economies of worth was crucial in the development of French pragmatism. Boltanski's and Thévenot's theoretical developments have been widely utilised, for example, in analysing the concrete process in which actor's relationship to values is constituted (Heinich 2020), and French pragmatism has affected both contemporary practice theoretical discussions and valuation studies. Overall, these traditions have different emphases, but they still have many historical connections.

Regarding influential contemporary scholars in the field of practice theories, one can mention, for example, Theodore Schatzki (Schatzki, 1996; 2002), Andreas Reckwitz (2002) and Elizabeth Shove (2012) with her colleagues. Practice theories often consider practices to be the 'smallest units' of social theory and social analysis (Reckwitz, 2002). For example, in their edited book *The Nexus of Practices* (2016), Allison Hui, Theodore Schatzki and Elizabeth Shove frame practices through the idea of a 'nexus of practices' that is at the centre of social scientific research. The nexus of practices is formed when organised bundles of actions (practices) are linked together and form a connection to 'wider complexes and constellations' (Hui et al., 2016, p. 1; see also Giddens, 1984). It is often stated that practice theoretical developments aim to overcome the dualism between agency and structure that is often apparent in social theory (Corsini et al., 2019). In this sense, practices are practiced between agency and structure: there are elements, such as material and social environment, that delimit and steer practices, but simultaneously, practices are carried out by competent people who may affect and change the practices under different circumstances (Warde, 2005). Thus, practices are not simply socially given (Cox, 2012). Practice theories have been used across different social disciplines and in examining various social phenomena, such as language, power, organisations and gender. In research focusing on environmental sustainability, which is the wider thematic field of this dissertation, researchers have adopted practice theories to study, for example, energy consumption (Gram-Hanssen 2011), food consumption (Plesz et al., 2016), mobility (Barr & Prillwitz, 2014) and online shopping of clothes (Joyner Armstrong & Park, 2020).

Several definitions exist for social practices in the tradition of practice theoretical research, and it is not possible to go into detail for all of them in this dissertation. In brief, the definitions provided, for example, by Reckwitz, Schatzki and Shove have

a different emphasis. Schatzki's (2002) definition stresses that practice theory, among other things, goes beyond individualist accounts of action and shifts the focus away from the cognitive processes of individuals, such as linear, purposeful and rational decision making (see also Cox, 2012). In addition, according to Schatztki, practice theory does not explain things through abstract social structures, such as class. One of Schatzki's (2002, p. 87) early definitions defines practices as a 'temporally evolving, open-ended set of doings and sayings linked by practical understandings, rules, teleo-affective structure and general understandings'. It is specific for Schatzki's definition of practices that the focus is on the teleo-affectivity of practices, which draws attention towards the projectivity and motivational orientation of practices (Welch et al., 2020). Article IV of this dissertation focuses especially on this aspect of motivational orientation by analysing different future orientations constituted in food waste-related practices.

While Schatzki places human action at the centre of his definition of practices (although he does not completely ignore the role of material entities as elements that shape and are shaped by practices) (Cox, 2012), Shove and her colleagues have more clearly focused on the developments in practice theory that consider objects, infrastructures and material environment as part of practices. This has been done in their work that analyses the production of consumer practices and 'the diffusion of products and technologies associated with them' (Shove & Pantzar, 2005, p. 62), as well as energy supply and demand as part of reproducing certain ongoing energy-intensive practices (Shove & Walker, 2014), among other things. In Shove's and her colleagues' work, people are often conceptualised as 'carriers of practices' (Shove et al., 2012), which refers to the constant and ongoing reproduction of practices carried out by people who perform them. Compared with other practice theoretical developments, it is specific to Shove's and her colleagues' work that it often emphasises how the evolution of practices contributes to societal transitions. Their analysis especially highlights how societal transitions may occur when certain practices emerge, evolve and disappear.

Reckwitz's (2002) definition of practices reads as follows:

> 'practice' (Ger. *Praktik*) is a routinized type of behaviour which consists of several elements, interconnected to one other: forms of bodily activities, forms of mental activities, 'things' and their use, a background knowledge in the form of understanding, know-how, states of emotion and motivational knowledge. (p. 249)

According to Reckwitz, practice and its elements form a 'block' that cannot be reduced to any single element within it. In this sense, according to Reckwitz,

practices are not simply 'habits', but they are composed of more complex bundles of different actions (see also Shove et al., 2012). In his definition, Reckwitz considers practices as routinised behaviour, and resulting from this, Reckwitz's definition of practices more strongly highlights the role of routines compared with those of Shove's or Schatzki's. Moreover, Schatzki (2016) has criticised Reckwitz's definition of practices for its' tendency to stress routines and regularity. According to this critique, focusing on routine and regularity is problematic since it too strongly stresses stability. Researchers have pointed out that practices are not necessarily only a stable and routinised form of behaviour, since practices can also include creativity, reflection and starting something new (Lehtonen & Pyyhtinen, 2021). This aspect of the practices is especially apparent in Article IV, in which I analyse the future orientation of practices through the idea of the transformativity of practices. The article contributes especially to future-oriented practice-based research (Mandich, 2020; Welch et al., 2020) by focusing on how the CE as a societal transformation is enacted through transforming both the practices and materials entangled with and within them.

Articles I and II draw from Reckwitz's definition of practices. However, as a whole, this dissertation does not strictly adhere to any specific definition of practices or stream of practice theories. Article II contributes to previous practice theoretical research, especially through its focus on forming ethical subjectivity (Foucault, 1994; Hawkins, 2006) in everyday practices and by analysing tensions between ethical goals and persistent practices. The previous practice theoretical literature discussed in this section (see, e.g. Reckwitz, 2002; Schatzki, 2002; Shove, 2012) has rarely explicitly analysed how ethics relate to and are formed in practices.

In addition to the fact that some of the articles of this dissertation lean towards the tradition of practice theoretical research, especially Articles I and IV draw from Mol's (2002) praxeological methodology. Praxeology refers to a methodological approach that focuses on how objects and their different realities are enacted and sustained in practice. This is analysed through an ethnographic exploration of how things are dealt with in practice and how the relations between objects are formed. In the book *The Body Multiple* (2002), Mol examines the enactment of reality by focusing on how atherosclerosis is done in clinical practices. Rather than analysing how one can claim knowledge of the body or the disease, Mol focuses on how objects, such as the disease, are done through a series of different practices. Mol's central argument is that there are always multiple potential realities for objects, depending on the way they are enacted in practices. For example, the food waste represented in national or EU statistics is very different from the certain mouldy

fruits and vegetables that we deal with in our everyday lives. Thus, food waste and the CE are always slightly different depending on the situation and the social relations with which they are entangled. These different realities are never given, but they are rather always made and sustained in active practices; thus, the different realities of objects are also political.

All the articles in this dissertation are based on the assumption that the CE of food waste is enacted in everyday practices at different sites. This focus on the enactment of the CE entails the practice-based approach, but it also illustrates how food waste and its circulation become very different depending on the relations and practices with which they are entangled. In this dissertation, the praxeological approach has affected both the theoretical framings of Articles I and IV as well as the data generation process. This means that when collecting the ethnographic data, I wanted to actively take part in the everyday practices in the field to form a hands-on understanding of the ways in which practices contribute to circulating and changing food waste and biowaste (the data collection methods are discussed in more detail in Chapter 5). In the following section, I will discuss valuation practices and the pragmatist approach to valuation.

4.2 Valuation practices

One central theme in this dissertation is the valuation of food/waste. In particular, Articles I and III focus closely on the practices of valuing food products and biowaste. In modern imagination, waste has usually been considered worthless, and the acts of disposing and ridding have thus been seen as practices of excluding the unwanted. The consumerist ethos related to waste has been 'out of sight, out of mind' (see, e.g. Strasser, 1999), and we have piled our unwanted things onto landfills, where they have been left with no further utilisation. Waste scholars, however, have pointed out that disposal is not always equal to the annihilation of value (Gille, 2010; Greeson et al., 2020; Reno, 2009). Practices such as re-using and scavenging have existed long before the breakthrough of CE thinking (O'Brien, 2011; Reno, 2009); however, in the modern consumerist economy, they have still been, to some extent, marginal and more limited to individual households. The CE aims to alter the operating principles of the economy and thus more broadly change the ways how citizens and businesses think about and act with waste—consumers should try new recipes to utilise dry crusts, retail stores are expected to sell their surplus food through mobile applications and donate it to food banks and biogas plants should

produce biogas and fertilisers from the scraps that consumers and businesses have not been able to prevent from ending up as waste. In this sense, the transition towards a CE aims to turn waste from a problem to a valuable resource on a large scale, thus making the opposition between value and waste less and less evident.

However, waste does not turn into value by itself. Transforming waste into value requires constant and ongoing practices of valuing. These valuation practices shape the ways in which our everyday activities and society are ordered (Helgesson & Muniesa, 2013)—citizens and businesses are expected to do unpaid work to prevent, treat and store waste and transport it to recycling centres. Furthermore, when waste is taken to a biogas plant or other waste treatment facilities, processing it into new assets also requires that people treat it and take care of the waste infrastructures. To grasp this concrete work of making waste valuable in the context of the CE, I draw from the pragmatist approach to value as valuation (Dewey, 1939; Helgesson & Muniesa, 2013; Muniesa, 2012), which I will discuss in more detail in the following.

For a long time, the sociological understanding of valuation often began from the idea that something has value as such and by itself, or that value is a result of cognitive judgement or social construction (Muniesa, 2012). However, pragmatist approaches to value drawing from American pragmatist philosophy (see, e.g. Dewey, 1939) or French sociology (Boltanski & Thévenot, 1991; Latour, 1989) have started to emerge during recent decades (Heinich, 2020). According to the pragmatist approach to valuation, no object is valuable as such or by itself, but its value is enacted in concrete socio-material practices. In other words, the focus is shifted away from intrinsic value to valuation as an action (Muniesa, 2012). Approaches that analyse value as a social construct have utilised, for example, discourse analytic methods (see, e.g. Lansing, 2011). Contrary to this kind of approach, the pragmatist approach to valuation in this dissertation means a focus on how value is socially and materially produced, i.e. how materials and their value are concretely shaped in practices and how, for example, acts of moving things between different spaces alter their value.

Studies that approach valuation from a pragmatist viewpoint have, for example, analysed the difference between the acts of valuation and evaluation (Lamont, 2012), examined the processes of attributing monetary value to things that are not usually evaluated or thought through their monetary value (Fourcade, 2011) and studied the registers of valuing in assessing whether tomatoes are good (Heuts & Mol, 2013). In the field of social scientific waste studies, researchers have drawn from the pragmatist approach to value as valuation in order to examine the hands-on practices of valuing discarded objects in dumpster diving (Lehtonen & Pyyhtinen, 2020),

ridding as a mechanism of valuing used books (Greeson, 2020) and separating valueless objects from valuable ones in the recycling industry business (Laser, 2020), among other things.

The way in which valuation can be seen as concrete action can be illustrated through an example of valuing leftover fruit and vegetables in the supermarket where I conducted my fieldwork. Some supermarkets, such as the one where I conducted the fieldwork, collaborate with business partners, such as companies that have designed mobile applications, for selling food that does not meet the quality criteria to be sold from shelves but is still edible. If a supermarket wants to, for example, sell vegetables that are not good enough to be sold from the shelves through the mobile application, it needs to do a lot of work to make them desirable for customers. First, the vegetables are removed from the shelves and then sorted, and then the mouldy and rotten ones are removed. The rotten ones must be collected separately and taken to the waste bins. Then, the ones that are still sellable at a reduced price are collected into bags, and these bags have to be stored somewhere before customers come to pick them up. The bags also need to meet certain quality criteria to keep customers happy. For example, they have to contain a variety of different products, and this requires that employees always have to assess what to include in the bags; thus, they cannot just dump all surplus products in them. Marketing these bags for customers (e.g. justifying why they should buy leftover vegetables in the first place) also requires work that is usually done by the business partners. Without all these valuation practices, a bag of leftover vegetables would not be a desirable product that an environmentally aware customer can buy to help tackle retail food waste.

However, valuation practices do not always contribute positively to the value of things, as seen in the previous example (valorisation, see also Vatin, 2013); they can also affect it negatively (devalorisation) (Heinich, 2020) and thus decrease or eliminate the value of a certain object. In addition, valuation practices can contribute to altering the statuses of objects in other ways. The ways in which competent people engage with things in certain situations create different modes of valuation (Çalışkan & Callon, 2010) that can sometimes be asymmetrical. The different modes of valuation also contribute to changing the statuses of objects. For example, an object's status may change from a gift to a commodity depending on how it is valued (Tsing, 2015), and different modes of valuation can sometimes clash or compete with each other. This can happen, for example, when monetary profits are valued over environmental benefits. Clashes between different modes of valuation are sometimes also apparent in the context of CE practices, as this dissertation (especially Article I) shows—people may, for example, value their own convenience

over preventing waste (Article II) or consider economic efficiency more important than attending to waste valorisation practices (Article I). These clashes inevitably create leakages and disruptions that complicate the circulation and valuation of materials.

4.3 Summary of the theoretical framework

In Chapters 2, 3 and 4, I have outlined the cornerstones of my theoretical approach in this dissertation: the focus on socio-materiality in examining food waste and related practices, problematising the CE through exploring potential disruptions in the hands-on practices of circulating food waste, the practice-based approach and the focus on valuation practices. In Chapter 2, I introduced social scientific waste studies and positioned my research within this scholarship. As a whole, in Chapter 2, I formulated a theoretical approach in which food waste is approached as a societal phenomenon that is entangled with different socio-material relations. In Section 2.1, I provided a brief overview of social scientific waste studies focusing on consumer practices related to waste and positioned my research within this line of research. I also examined and problematised the moralistic undertones related to consumer waste in contemporary discussions. By seeking to avoid moralistic or normative undertones related to waste, this thesis explores food waste as part of and constitutive of different societal processes and not simply as a problem that has to be avoided or solved. After this, Section 2.2 discussed research concerning waste in retail and in the waste management context. I also positioned my dissertation in relation to this previous research and highlighted the importance of examining waste along the supply chain to follow the changing rationalities related to waste in different environments. Section 2.3 positioned my research theoretically and methodologically within the field of social scientific waste studies. In more detail, I stated that this dissertation approaches waste from a relational and negative viewpoint. This means that I see waste as not having any strong defining characteristics and as constitutive of society. In Section 2.4, I deepened this theoretical and methodological positioning by discussing the materiality of waste and socio-material practices. In my dissertation, a focus on socio-material practices especially means that I do not analyse waste through a social constructionist approach or see waste as something that comes to be through symbolic categorisation of things as pure or impure (see Douglas 1966). Rather, I see waste as

something that is done and produced through different socio-material and spatial processes.

Chapter 3 discussed the CE of food waste and a critique of the CE. In this chapter, I contextualised the current discussion concerning the CE of food waste in the Finnish and EU contexts and explicated how I approach the CE critically. Section 3.1 analysed the characteristics of food waste as a specific type of waste, mapped the public discussion concerning food waste in Finland, discussed the research on food waste practices in households, supermarkets and biogas plants, showed how the practices of these actors are interconnected and how the responsibility for food waste generation is distributed across the food chain (see also Welch et al. 2021). Section 3.2 focused on different CE definitions and EU CE policies. In this section, I stated that I approach the CE in the context of this dissertation as 'a system that is constantly enacted and sustained in concrete hands-on practices that make materials circulate and contribute to keeping them in circulation' (Article III; Holmberg & Ideland, 2021). I also discussed the CE transition of the food system and presented the food waste hierarchy, which is the guiding principle of EU CE policies. Section 3.3 presented studies that are critical towards the CE and explicated how this dissertation approaches CE critically, especially by focusing on hands-on practices and pointing out different situations in which these practices fail to make food waste perfectly circular.

Chapter 4 introduced the practice-based take of this dissertation, as well as the pragmatist approach to value as valuation. These two theoretical streams form the framework through which the concrete making of the CE of food waste is understood in this thesis. In Section 4.1, I discussed the practice-based approach, practice theory and praxeology. I highlighted that some of the articles of this dissertation draw from the tradition of practice theory; however, as a whole, this dissertation is situated within a wider family of practice-based research. I also discussed Mol's (2002) praxeological approach, which guided the methodological take of this research. Section 4.2 examined the pragmatist approach to value as valuation as well as the significance of valuation practices for the making of a CE. In the following chapter, I will discuss multi-sited ethnography as a research method.

5 METHOD: MULTI-SITED ETHNOGRAPHY AND FOOD WASTE DIARIES

In this chapter, I will discuss the research methods and data collection process of this dissertation. I will also consider research ethics. In Section 5.1, I present multi-sited ethnography as a research method, exemplify the contribution of my ethnographic fieldwork to the field of social scientific waste studies and research on the CE and justify the selection of the sites in this study. Section 5.2 specifies the data collected from different fields, describes my role in the fields and elucidates the process of accessing the fields. In Section 5.3, I describe the diary methods utilised in this dissertation and the relation of this data to the ethnographic fieldwork. I also describe the data collected from the food waste cooking workshops. In Section 5.4, I explain the data generation and analysis. Section 5.5 concerns research ethics.

5.1 Multi-sited ethnography and selecting the sites

This thesis ethnographically follows the journey that food undergoes in the final phases of the food chain. I conducted ethnographic fieldwork in a supermarket and two biogas plants. Although I did not conduct ethnographic fieldwork in households (I will describe the data collection in households and its compatibility with the ethnographic data in more detail in Section 5.3), I describe it as one of the fields in this section to illustrate the information that my empirical work has produced as a whole.

Originally, ethnography was a method mainly used by anthropologists to examine 'exotic' settings and distant others to understand different communities and societies; however, these days, ethnographic fieldwork is conducted to analyse different social worlds in a more diverse manner (Atkinson et al., 2001). For example, in the field of STS, ethnography has become a key method over the past few decades (Lippert & Mewes, 2021). The aim of ethnographic analysis is to immerse the researched field and determine what research participants consider important and meaningful in their everyday lives (Emerson et al., 1995). It is characteristic of ethnographic research that the researcher goes to the field and participates in the

everyday activities involved, thus becoming an insider in the field. Sarah Pink (2007) states that ethnography is not merely a method of collecting data, and defines ethnography as

> a process of creating and representing knowledge (about society, culture and individuals) [...] It does not claim to produce an objective or truthful account of reality, but should aim to offer versions of ethnographers' experiences of reality that are as loyal as possible to the context, negotiations and intersubjectivities through which the knowledge was produced. (p. 22)

In other words, this can, for example, mean that the ethnographer should always take the context of different interactions in the field into account when making interpretations. In addition, they should be careful about presenting their own interpretations about different situations and ensure that research participants interpret the situations within a similar framework.

In the field of social scientific waste studies, ethnography has been among the key methods used, especially in research that focuses on the materiality of waste and the socio-material practices of handling it. Researchers have, for example, analysed the politics of value in a landfill by examining the informal scavenging practices of landfill employees (Reno, 2009). Scholars have also analysed the practices of valuing electronic waste in a high-tech recycler (Laser, 2020) and explored the household practices of living with things and the active practices of ridding them (Gregson, 2007). Ethnographic analysis has also been conducted on bokashi composting as an alternative practice of living with waste (Kinnunen, 2021) as well as on the conduits of disposing of household food waste (Evans, 2012b). However, not many multi-sited ethnographies have been conducted in the field of social scientific waste studies (for exceptions, see, e.g. Gille, 2001) that would follow the changing practices of handling waste across different systems.

In this dissertation, I conducted a multi-sited ethnography (Hannerz, 2003; Marcus, 1986, 1995). This means that instead of collecting the data at one site, the ethnographic fieldwork was conducted at several different sites that considerably differ from each other. In his pioneering work, George Marcus (1995) states that multi-sited ethnography is

> designed around chains, paths, threads, conjunctions, or juxtapositions of locations in which the ethnographer establishes some form of literal, physical presence, with an explicit, posited logic of association or connection among sites that in fact defines the argument of the ethnography. (p. 105)

When selecting the fields of this research, I wanted to follow the journey that food undergoes in the final phases of the consumption process. However, this

research does not empirically analyse how the connections between the sites of the research are concretely constituted; rather, it focuses on the practices within each examined field. Thus, the connections between the sites of this study are not concretely constituted in this dissertation. Instead, the multi-sited ethnography in this thesis is designed around following how the CE of food waste is enacted in concrete practices within different environments. This approach can be described through the methodology of 'following the thing' (Cook, 2004; see also Appadurai, 1986) or, more precisely, through a methodology that Holmberg and Ideland (2021) developed in their work on biogas production in Sweden that they call trash-tracing. They describe their methodological approach inspired by Kopytoff's (1986) idea of a 'cultural biography of things' as follows: 'This action-oriented approach means we avoid starting from the top of the organization and studying "down", but rather "follow the trash" in order to get a grip of waste regimes' (Holmberg & Ideland, 2021, p. 349). Although I do not focus on Zsuzsa Gille's (2007) notion of waste regimes[6] in my research, in the same vein as Holmberg and Ideland, I wanted to follow the trash and the practices with which it is entangled when designing the multi-sited ethnography and choosing the sites in this dissertation. I have done this instead of, for example, only observing or discussing with people at the top of the organisation. In other words, I wanted to examine the mundane hands-on actions related to food waste that take place in the examined environments.

In his methodological developments of multi-sited ethnography, Marcus (1986, 1995) especially focused on different social orders, such as capitalism, and how they were enacted and displayed in multiple arenas. However, to date, the idea of multi-sitedness has been utilised in studying various different phenomena. Researchers have conducted multi-sited ethnography, for example, to study energy infrastructures (Silvast & Virtanen, 2019), learning in cities (Facer & Buchczyk, 2019) and forced migration (McAdam-Otto & Nimführ, 2021). My study specifically analyses food waste and related practices at sites that vary from each other rather significantly. In other words, I do not focus only on, for example, household food waste practices in different contexts, such as in several different countries or cities,

[6] My approach differs significantly in terms of scale for from Gille's (2007) focus on 'waste regimes' which refer to patterns that are specific to the social nature of waste in different societies and time periods. According to Gille, different waste regimes affect practices through which waste is dealt with and approached in particular societal and political settings. Rather than being interested in different epochs of waste management practices, in my work, I focus on the specific practices and different enactments of the CE in particular sites.

but on practices at multiple sites across the end parts of the food chain. Above all, my focus on these different environments has enabled me to follow how food waste and the CE are enacted in various ways in different environments.

In my view, the methodological value of multi-sitedness in the context of my research is that it has enabled me to examine fields that constitute each other and that all these fields still have their own dynamics, characteristics and operating principles (see also Strathern, 1999). This makes it possible to analyse and juxtapose the changing sensitivities and rationalities related to food waste along the food chain. In my study, I have been interested not so much in the social relations in the researched fields or in the employees of the stores and biogas plants as social groups, but I have rather focused on the configurations of different relations in these fields (Desmond, 2014). Here, I draw especially from assemblage thinking (Deleuze & Guattari, 1987; Pyyhtinen, 2015). The notion of 'assemblage' refers to a coming together of human and more-than-human entities in different formations and networks that produce agency (Page, 2020). This means that I see several human and nonhuman elements, such as human practices, the material qualities of food, waste treatment technologies, different spatial factors and refrigeration, all contributing together to what food turns into inside and in between different sites of the research. In addition, the sites of this research are interconnected and affect each other. For example, retailer practices affect the purchasing behaviour of households, consumer practices shape the operation of retail stores and waste treatment in biogas plants both affects and is affected by retail store and household practices.

This kind of orientation also means that when conducting my ethnographic fieldwork, I have not focused only on humans and their practices as the main source of information; my aim has also been to stay sensitive towards the capability of food, waste and other materials to create different kinds of effects and affect the ways in which they can be dealt with. However, some articles of this dissertation more strongly emphasise the capability of food, waste and other materials to actively affect the practices (see Section 2.4).

I consider it important to also reflect on how the sites of this research relate to each other, why I chose them among all possible sites where food waste is dealt with and what kind of information they offer concerning the CE of food waste. All the sites of this research are entangled with the wider networks of the production–consumption system, and there are several relations in these networks that I have not been able to include in my examination. For example, while retail practices (such as too large package sizes or price promotions, see, e.g. Mondéjar-Jiménez et al., 2016) have an effect on the amounts of household food waste, retailers also affect

the food waste of producers, for example, through quality standards (Mena et al., 2011). I have not analysed food waste generation in food production in this dissertation at all, and I have deliberately chosen to focus on the end stages of the food consumption process. Moreover, there are other businesses in addition to retail stores that distribute food and produce food waste that I have not included in my examination—most obviously restaurants and canteens. Further, the practices of biogas plants are connected to several different industries and government sectors, such as the energy sector, agriculture and environmental and health protection. Although this dissertation analyses how the possibilities of valuing biowaste in biogas plants are entangled with the operations of the agriculture and energy sectors (Article III), I have not explicitly analysed, for example, how the practices at biogas plants are connected to environmental and health protection, which are also intrinsic parts of waste management.

The exclusion of these issues from this dissertation is most obviously related to defining the scope, methods and questions of the research. I have identified the three most important justifications for the selection of sites in this dissertation. First, ethnographic fieldwork is a very time- and resource-consuming data collection method, and this imposes certain limitations on the selection and number of sites that can be included in the research. If I had, for example, analysed government documents related to food waste or conducted interviews with multiple stakeholders, this would have probably enabled me to involve a wider scope of actors in this research. However, I did not do this since the methodology of this research is rooted in a focus on situated practices, and the ethnographic approach employed in this research suits this methodological choice better. Furthermore, I have excluded certain aspects of waste management, such as health and environmental protection, from this study because they are not closely related to my research questions.

Second, one may still ask why I have chosen to focus particularly on supermarkets, households and biogas plants when there are also many other actors in the end part of the food chain that produce food waste, such as restaurants and catering services. The main reason for choosing these sites among all possible sites is that the link between retail stores and household food waste practices is more obvious than that between restaurants and household food waste practices. For example, when analysing the practices of reducing and producing food waste in households, it made sense to ask how the participants planned their shopping to reduce food waste at home, but potential visits to restaurants or canteens were not that clearly relevant from the viewpoint of dealing with food waste at home, since not all people regularly eat at restaurants, but most people have to go the store

weekly—and, obviously, both household and retail practices are connected to biogas plants.

From this, we get to the third and final justification for the selection of the sites of this research. One central criterion in the selection of the sites of this study has been that all the sites are interconnected, but they all still individually tell something interesting about the changes in the ways people deal with food (waste) along the food chain, how food waste itself changes along the process and how the practices both enact and complicate the CE. This is a major contribution of my ethnographic fieldwork to the field of social scientific waste studies, as well as the research on the CE. Food is a necessity for consumers, but it is also something that is sometimes purchased only for pleasure or without much planning, which occasionally leads to food waste and concerns related to it. Thus, for consumers, food waste is clearly a problem and something they need to reduce and eliminate; however, it is also something that is often accepted as part of normal household practices (Article II; Evans, 2012a). Further, for retailers, food is a valuable commodity, and their most important goal is to retain efficient business operations. Securing the availability of items sometimes means that food waste must be accepted as part of store operations (Article I; Gruber et al., 2016). In this sense, the controlled production of food waste in the retail context seems to be an unfortunate necessity. In biogas plants, food waste, or, more precisely, biowaste, is not mainly framed as a problem but as a resource for energy and fertiliser production (Article III; Holmberg & Ideland, 2021). In addition, although several waste management companies campaign for food waste reduction and therefore do not approach food waste indifferently, their position in the food chain is still very different compared with households and retail stores, which are often responsible for reducing food waste. Biogas producers, on their part, are usually viewed as actors that contribute to the sustainable utilisation of food waste that other operators in the food chain have not been able to prevent. In this sense, all the environments of this research produce knowledge about dealing with food waste and enacting the CE from different angles. In the next section, I will describe the fields of my research in more detail, explain how I accessed them and reflect on the research process and my role in the fields.

5.2 Researcher's role during the fieldwork and accessing the fields

The ethnographic fieldwork that constitutes the data of this dissertation was conducted in three separate fields: households, a supermarket and two biogas plants.

While ethnographic observation was conducted on-site in a supermarket and two biogas plants, the data collection conducted in households did not include actual participant observation in people's homes. Instead, 26 food waste diaries were collected from Finnish households. In addition, field diary entries collected from four leftover cooking workshops were utilised in Article II. This section will focus on describing the fieldwork in the supermarket and biogas plants, and the diaries and leftover cooking workshop material are presented in more detail in Section 5.3. Table 1 illustrates the different datasets of this dissertation.

Table 1. Data collection

	Households	**Supermarket**	**Biogas plants**
Collected data	26 food waste diaries, participant observation in 4 leftover cooking workshops (Finnish Martha Oraganization & Wastebusters group)	4 weeks (120 h) of ethnographic observation in a retail store, ethnographic interviews	3 weeks (75 hours) of ethnographic observation in two biogas plants and ethnographic interviews, 11 semi-structured interviews with experts and managers working in the biogas sector
Time of collecting the data	2018–2019	2019	2021

As the table shows, the field periods in the supermarket and biogas plants lasted from three to four weeks. The fieldwork in the supermarket was conducted during one continuous four-week period in September 2019, whereas the fieldwork in the two biogas plants was conducted in four separate parts during the spring and fall of 2021. In multi-sited ethnography, fieldwork may include multiple field periods instead of spending extensive time in one field. While some more 'traditional' ethnographies that aim to understand the social organisation of a certain society or community often last for several years (Hannerz, 2003), the fieldwork I have conducted in this study has focused, to a limited extent, on routinised and redundant

everyday practices that relate to dealing with food waste and biowaste. Gaining an understanding of routinised practices that relate to the rather limited issues of food waste and biowaste did not require spending extensive time in the field.

Researchers have pointed out that the degree of participation may vary between ethnographies. The roles of the researcher can vary from being a complete participant to being a complete observer (Gold, 1958). Of course, these roles are strong generalisations, and they can always change and mix in different situations during fieldwork. Thus, it is not convenient to make any rigid categorisations here concerning my role in the field. In general, however, it can be said that my role as a researcher was, to some degree, different in the supermarket and biogas plants. In the supermarket, my participation was rather strong since I actively participated in the everyday activities of the store. Because of this role, I felt that the store employees and customers perceived me as one of the employees, and this clearly affected my role and relationships in the field. In the biogas plants, however, I was not able to participate in work-related tasks to the same extent as in the supermarket, as it would have required more technical skills from me and more effort put into orientation. It was not convenient to arrange an orientation for work-related tasks, such as maintenance, in the rather short time that I had spent in the field, as it would have made it difficult to focus on the operation of the plant as a whole. Thus, I took on more of an observer's role in the biogas plants, but I still helped the plant employees in some simple work-related tasks and actively asked questions and had discussions with them while they worked. In this sense, I was not a complete observer who would not have affected the situations in the field (although 'a silent observer' also always has some effect on social settings).

Scholars have noted that the personal characteristics of the ethnographer inevitably affect the relations that they form in the field (Hammersley & Atkinson, 2007). This became apparent in one way or another in both fields where I conducted the ethnographic fieldwork. In the supermarket, I assume that my age affected the way the store employees perceived me. I felt that I was seen first and foremost as some sort of trainee (and maybe also a university student) and not primarily as a researcher. During the fieldwork in the supermarket, I was 24 years old. I assume that the response to my presence would have been quite different had I been a middle-aged professor. However, I considered it mainly a good thing that my position as a researcher did not define my role in the field too dominantly. Nevertheless, my unclear role also made me feel a responsibility to remind the employees at times that I was making notes about my observations in the store. Although I sometimes thought that I was seen as some sort of trainee, it was still

clear to the store employees who participated in the research that I was a researcher, and I told them all very concretely that I will write a research article based on my observations. I described to them the process of writing a research article and told them that I may, for example, quote them in my work that will be published. As I did not interact much with the customers of the store or did not focus on these interactions in my study, I thought it was not necessary to clarify my role in the store to the customers. This would not have been even possible considering the great number of customers who visited the store every day, and it could also have potentially endangered the anonymity of the store employees in my study. All the employees who participated (both in the supermarket and biogas plants) signed a research agreement, and this is discussed in more detail in Section 5.5.

In the biogas plants, my role was, to some extent, different owing to the different methods of participation compared with those applied in the store, and I felt that I was more clearly seen as a researcher there. This became apparent most clearly in situations when I asked whether I could help, for example, in cleaning the slurry from the floor of the biowaste pretreatment hall—the managers and employees were sometimes clearly sceptical about giving me any 'dirty tasks', although I tried to constantly make it clear that I was not afraid to 'get my hands dirty'. Regardless of the fact that my role as a researcher seemed to be clear to the employees of the plant, I still made sure to concretely describe what I planned to do with the collected data. I did this, for example, by telling the employees that I may quote them in my research articles that will be publicly available.

Ethnographic fieldwork concerning the retail sector was conducted in a large supermarket located in a central place in one of the largest cities in Finland. During the fieldwork, I participated in daily work-related tasks with the section managers. My tasks included shelving the products, organising the shelves and removing spoiled or soon-to-be spoiled products from the shelves, and making food waste bags to be sold through Food Waste Application[7] (for a more detailed description on the store and work tasks, see Article I). Alongside working, I held discussions with the section managers and other employees and asked them questions about their work and food waste management in the store. These kinds of ethnographic interviews were also conducted during coffee and lunch breaks.

I gained access to the supermarket by contacting the shopkeeper through the online contact form of the store. Before commencing fieldwork, I met once with the

[7] Food Waste Application (pseudonym) is a mobile application that allows retail stores and restaurants to sell their leftover food at a reduced price.

shopkeeper, and we discussed the practicalities of the fieldwork. I also explained to him the aims of my study and the overall aim of my thesis. Based on the meeting, I got the impression that the shopkeepers' attitude towards my research was rather positive, and there were no specific concerns or doubts from his side related to my observation period in the store. This might relate to the fact that, in the Finnish retail sector, actors are quite used to communicating about their food waste and reporting their food waste in their sustainability reports (Mesiranta et al., 2022); thus, they may not consider this topic to be particularly sensitive. In the meeting with the shopkeeper, we agreed rather quickly that the most 'natural' way to conduct the observation period would be to participate in work-related tasks with the section managers. The shopkeeper thought that this would also probably feel more convenient from the viewpoint of the employees, the other option being me observing their working from the side lines. He told me which sections were potentially most interesting from the viewpoint of food waste management, and we chose the sections where I would conduct the fieldwork based on this input.

I asked the shopkeeper to inform the employees beforehand about my upcoming observation period. I also told him that it would be good to inform the employees beforehand that they had the right to refuse to participate in the research. The shopkeeper responded that he was quite sure that no one would refuse to participate. However, at the beginning of the fieldwork, I personally asked each employee who took part in the research for their consent. When I started my observation period in September 2019, I felt that the employees viewed my presence in the store as approving, and they were eager to share their opinions and expertise about food waste management in the retail sector with me. I did not feel that I had to try hard to get their trust; rather, the discussions occurred quite naturally alongside working together. One of the employees even told me how good a worker I am and asked me to apply for a part-time job at the store if I needed to earn a bit on the side at some point while doing my PhD studies. The employee also told me that she could provide me with references if needed.

While the ethnography concerning the retail sector was conducted in one supermarket only, the observations in biogas plants were conducted in two different biogas plants that treat both biowaste and sewage sludge as well as small amounts of some other waste streams. The biogas plants were pseudonymised as Southern Biogas LTD and Western Biogas LTD for this research. The plants were located in different parts of Finland, and the other plant was significantly larger (for a more detailed description of the plants, see Article III). In the plants, I mainly observed the tasks of the maintenance workers, such as routine maintenance, feeding and

running the waste treatment process and conducting different infrastructure development projects. During the observation, I asked the maintenance workers questions concerning their work. In addition, especially in Western Biogas LTD, the CEO of the plant participated very actively in planning my fieldwork and shared a lot of his knowledge during the ethnographic interviews that I conducted in the field and during our joint lunch breaks. I did not participate in work-related tasks in the plants to the same extent as I did in the retail store. I still occasionally helped the employees with some simple tasks, such as cleaning. During my two observation periods at Western Biogas LTD, I also joined a truck driver working as a subcontractor for the plant in his trips to supply fertilisers to farmers.

Getting access to the biogas plants was more laborious than getting access to the store. This was not apparent from the beginning, but during the process, access had to be negotiated several times. This was partly due to the COVID-19 pandemic and the long duration between my first contact with the plant and the actual fieldwork. I was originally promised access to Southern Biogas LTD at the beginning of 2019. At that time, my plan was to conduct fieldwork only in this plant. I contacted the plant through their online contact form and received a response rather soon. We organised a meeting in March 2019. The participants of the meeting were the person who had answered my contact request (at the time, he was working as a quality expert in the plant), the plant manager and one other person working in the management of the plant. In the meeting, they first told me about the plant and its business as a whole, and then gave me a tour of the plant area. In the meeting, I talked about my research and my aims for the fieldwork to be conducted in the plant. At the time of the meeting, there were still some uncertainties related to the funding of my fieldwork and the PhD project as a whole. Thus, we agreed that I would contact them again when I was granted the funding to conduct the fieldwork.

In February 2020, just before the COVID-19 pandemic hit, I was granted a three-year research grant from the Finnish Cultural Foundation that would allow me to complete my fieldwork and dissertation. At that time, I was working in university administration and was planning to resume my dissertation in the beginning of the year 2021. In March 2020, I emailed my contact person at Southern Biogas LTD and asked whether they would still be willing to participate in the research. They responded affirmatively, and we agreed that the fieldwork would take place during the year 2021 and that I would get back to him at the end of 2020 so that we could discuss the details. At the end of 2020, we scheduled an online meeting that took place at the beginning of 2021. In this meeting, we discussed the practicalities of the fieldwork, and I suggested that I could either participate in work-related tasks or be

more of an observer, depending on what would be more convenient for the employees with whom I would spend time in the field. We did not have as clear a plan about the nature of my participation as we did with the supermarket, mainly because there are not as many simple and straightforward work tasks in biogas plants as there are in the supermarkets. We agreed that the fieldwork would take place in May 2021, depending on the restrictions related to COVID-19. As a back-up plan, I started to recruit interviewees from different Finnish biogas plants and expert organisations in case the fieldwork had to be cancelled.

During the spring 2021, I conducted 11 interviews with experts and managers working in the biogas sector through Microsoft Teams (due to the pandemic). During spring, when I attempted to organise the practicalities of my planned observation period at Southern Biogas LTD in May, I faced some difficulties in getting in touch with my contact person in the plant and did not get a response to many of my calls and emails. This made me somewhat worried, since I felt that it was slightly unclear whether I still had access to the plant. By coincidence, when I was conducting an interview with the CEO of Western Biogas LTD, he suggested that I could visit their plant as well if I was interested. After the interview, partly resulting from the insecurities related to the fieldwork in Southern Biogas LTD, I contacted the CEO and asked whether it would be possible to arrange a one-week field trip to the plant, and he agreed. I, however, also received a response from Southern Biogas LTD later, and it turned out that I could also carry out my field trip there, although it had to be slightly shortened.

I still managed to negotiate two short additional field visits to both plants for fall 2021 during the fieldwork in spring. Thus, despite some communication difficulties and insecurities related to the COVID-19 pandemic, I still managed to spend three weeks in the field. In both plants, the employees responded to my presence rather positively, and they were often very eager to show me the plant and tell me about their daily work. Even though I felt a bit awkward at times to follow the employees and just 'watch them work', I still mainly felt that I did not need to struggle to gain their trust. I was treated in a very friendly manner at both plants. I also felt that the employees were generally happy to answer my questions and share their knowledge. In the next section, I describe the diary methods and the observation material collected from food waste cooking workshops and discuss how this data relates to the ethnographic material collected from the supermarket and the two biogas plants.

5.3 Diary methods and food waste cooking workshops

The research material of Article II comprises 26 food waste diaries collected from Finnish households during 2019 and field observation material collected from four leftover cooking workshops organised in collaboration with the Finnish Martha Organization and Wastebusters research group. In Article IV, which concerns all the fields of this study, only food waste diary material was utilised in studying household practices. The cooking workshops were organised during 2018, and they were documented by the Wastebusters research group using the EthOS mobile application[8]. In the food waste cooking workshops, the participants cooked meals from leftover food, and the researchers observed the process of cooking and conducted ethnographic interviews during the events. I did not personally participate in observing the workshops, but detailed field diaries were available to me while I was working in the Wastebusters group during 2019. Since ethnographic methods rely very strongly on the researcher's presence in the field (Emerson et al., 1995), there are certain problems related to analysing ethnographic material produced by other people. The analysis in Article II, however, primarily focused on food waste diary material. In addition, the analysis concerning the participant observation material mainly focused on ethnographic interviews conducted in the workshops and not so much on more ambiguous descriptions of different situations and sensations in the workshops. The discussions in the workshops were also carefully documented in field diary entries, and the interpretations I made in the analysis were checked and accepted by the researchers who conducted the ethnographic observations.

The research participants who kept the food waste diary were recruited by sharing the research call in different Facebook groups and through my personal networks. I encountered some difficulties in finding male participants for my research and thus tried to pay special attention to recruiting males by highlighting in the research call that I was especially looking for male participants. Regardless of the additional efforts made to find male participants, only two out of the 26 participants were male. Such difficulties were expected, since women tend to be the ones responsible for cooking, planning meals and dealing with leftovers (Cappellini and Parsons, 2013). Furthermore, generally, the participants were especially concerned about food waste and other sustainability issues. The possible limitations related to this are discussed in more detail in Article II.

[8] EthOS is an application available for mobile phones that allows users to create field notes and add pictures and videos taken and recorded in the field.

Diaries differ from other forms of qualitative research, such as interviews. This results from the fact that in diaries, people describe their perspective on situations shortly after an event has occurred, whereas in interviews, the descriptions might be affected more strongly by retrospective reflections (Bartlett & Milligan, 2015). In addition, diaries enable research participants to actively participate in creating the data and reflecting on the process (Miligan & Bartlett, 2019). The food waste diaries collected for this research can be categorised as solicited diaries. Solicited diaries have been previously used to analyse such diverse phenomena as the long-term effects of flooding (Whittle et al., 2010), breastfeeding difficulties (Williamson et al., 2012) and communication through text messages (Patterson, 2005), among other things. There is an essential difference in analysing a voluntarily kept diary and a solicited diary, since solicited diaries are kept for some specific reason and usually result from a specific request to do so (Miligan & Bartlett, 2019).

I consider solicited diaries methodologically compatible with my ethnographic approach in this dissertation. Regularity and contemporaneousity, among other things, are key features of diary-keeping (Alaszewski, 2006). Regularity simply means that diary entries are written regularly, whereas contemporanousity implies that events are written down in the diary soon after they have occurred; thus, the problems of recall are minimised. In this sense, diary material is suitable for examining repetitive everyday situations and practices related to food waste, and the contemporaneus nature of keeping a diary has many similarities with ethnographic fieldwork. When keeping the diaries, the research participants became observers of their own behaviours and feelings. This allowed me to analyse how the research participants observed their own behaviour, how they aimed to change it and what kind of moral considerations occurred when dealing with food waste.

The main reason I ended up collecting food waste diaries from households instead of conducting on-site ethnographic observation at people's homes (as I did in supermarkets and biogas plants) was that I wanted to pay specific attention to the continuous work and reflection related to food waste in homes. Of course, it could have been possible to observe this on site, but this would have required spending extensive time in each observed household, and going into people's homes would have been much more invasive than collecting the diary data. Collecting the diaries enabled me to include more people in the research, since I considered it important to collect the data from a minimum of 20 households to get a nuanced view of the practices of people in different situations in life. Moreover, the diary can be seen as a disrupting element in everyday life that motivates the research participants to observe, reflect and, in some situations, even change their own behaviour over a

certain period of time (although my main goal in collecting the diaries was not to make any kind of 'intervention' to participants' practices). Thus, the diaries were methodologically more suitable in relation to the framing of my research question in Article II than conducting ethnographic observations at people's homes.

When collecting the food waste diary material, I asked the participants to keep the diary daily for 2–4 weeks. I gave them ready-made diary templates. In the diaries, I instructed the participants to write down every day whether they discarded food and, if they had discarded it, how much, what kind of food it was, where it ended up and how they felt about this. In addition, I asked them to note if they used some measures to prevent food waste, what kind of measures they used, how this felt and whether it required much effort. I also requested them to specify whether they had gone to the store, how they had planned their shopping and what they bought. At the end of the diary-keeping period, the participants reflected on how keeping the diary might have affected their behaviour with food waste. Participants' descriptions of how they thought they could change their behaviour, what kind of planning and effort they already made to avoid food waste and on which occasions they considered food waste unavoidable came up as one of the most central focus points in the analysis of Article II. This was especially interesting since it revealed interesting hierarchies between different everyday ethical goals. Often, food ended up as waste as a result of routinised behaviour, such as making too much coffee every morning, but sometimes other ethical goals, such as making sure that the food that the family eats is safe, overruled the goal of avoiding food waste.

When examining such a morally charged topic as food waste production in households, it is important to reflect on how keeping a diary and making the behaviour related to food waste visible to a researcher might have affected the participants' practices, reflections and reporting when keeping the diary. Some participants even highlighted that keeping the diary made them more aware of their own behaviour. In this sense, the diary thus partly creates a setting that steers participants to monitor themselves and makes them particularly aware that their behaviour might be judged, although my aim has not been to moralise the research participants. However, in the end, there is nothing particularly different in this setting compared to many other methods in qualitative research—for example, when conducting interviews or ethnographic fieldwork, the researcher always inevitably affects the interaction and data through different power relations between the researcher and research participants (Emerson et al., 1995; Saldana, 2011). In the following section, I will consider the process of creating and analysing the data of this dissertation in more detail.

5.4 Creating and analysing the data

In this dissertation, a focus on the socio-material practices of treating food waste is a central element. This has affected not only the ways of analysing the data but also the methods of collecting and creating it. The praxeological approach (Mol, 2002), which was already discussed in Section 4.1, has been a focal component in my data creation process. Moreover, in all the articles of this dissertation, the reading and the analysis of the data were guided by certain theoretical concepts and ideas (the process of analysing the data is described in more detail in Articles I–IV). Next, I will discuss the generation and analysis of each dataset in more detail.

When collecting the food waste diary material from households, I wanted the data to enable me to not only analyse the cognitive judgements related to the practices of producing and reducing food waste but also grasp the materiality of food waste by asking the participants questions about what they concretely do with food waste in their everyday life. I did this, for example, by asking about where food waste was placed. I also asked what kind of measures the participants used to prevent food waste, and this often led to rather rich and detailed descriptions of how leftovers were stored, how they were utilised in cooking and how future meals were planned so that the leftovers could be utilised later. In the field diary entries collected from the food waste cooking workshops, socio-material practices were grasped, especially through the description of concrete action in the workshops. The theoretical framework that later steered the analysis of the data was not completely clear during the time when the data concerning households was collected. However, when planning the collection of the food waste diaries, it was clear for me that the analysis will focus, in one way or another, on ethical considerations related to food waste. Thus, the questions in the food waste diary templates were designed with this goal in mind. When the data concerning households was analysed, both Foucault's (1994) conception of ethical work and practice theoretical framework guided the analysis and reading of the data (these theoretical frameworks are discussed in more detail in Article II and Section 6.3.).

During the ethnographic fieldwork in the supermarket and biogas plants, I participated in daily work-related tasks, which defined both the data generation and my role in the field. Participating in these tasks was a methodological choice made when planning the fieldwork. It was a way to learn how food waste and biowaste are processed hands-on in the examined environments and how they are moved along and circulated between different spaces. However, in the supermarket, I participated much more actively in work-related tasks than in the biogas plants because of the

reasons that were described in more detail in Section 5.2. Participating in these tasks was useful, on the one hand, for gaining the trust of the people in the field and forming a hands-on understanding of the food waste management practices in the store, but on the other hand, it affected my ability to write detailed fieldnotes on the spot (see also Article I). Accordingly, I usually wrote short jottings during coffee and lunch breaks and more extensive field diary entries after the day spent in the field. It has, however, also been pointed out that it is good to be flexible in writing fieldnotes, depending on the social setting in the field (Emerson et al., 1995), and I did not concern my inability to write fieldnotes while working as an enormous issue, since I still was able to write proper field diary entries every day immediately after spending time in the field. Since my role in the biogas plants was less active than in the supermarket, I was able to write more extensive jottings on the spot. I consider this mostly a good thing, since gaining a basic-level understanding of the operation of the plant required active writing of notes, whereas it was rather easy to learn the socio-material practices of dealing with food waste and the operation of the store by engaging in work-related tasks at different sections of the store.

In the supermarket and biogas plants, I worked hands-on with waste materials, but I also paid attention to the technologies and infrastructures with which food waste and biowaste are entangled. This was especially apparent in biogas plants since the technologies and infrastructures of the plants are usually not visible for people who do not work in the waste management sector; thus, gaining an understanding of the operation of the plant required special efforts. In practice, this means that I wrote down in my fieldnotes what kind of spaces and with what kind of equipment food waste is moved along in the researched environments (e.g. backrooms, loading bays, trolleys, trucks and machines). In other words, I focused not only on what people say about food waste or biowaste but also on what people do with it and what kind of material entities participate in the process of circulating it. In this sense, people were not the only informants during the fieldwork (see also Latour 2005). However, of course, I mostly had to rely on things that were said by people. I, for example, did not have access inside the biogas reactors to see what happens inside of them. In these situations, I had to rely on people's descriptions and other kinds of representations, such as figures on the computer screen, that presented the operation of the reactors. While doing the fieldwork, I did not record the discussions that I had with the research participants. This was mainly because of practical reasons—in the store, it would have been difficult to record conversations with the research participants while making sure that outsiders' discussions (mainly customers or sales representatives) would not accidentally be recorded without consent. It

would also have been rather difficult to carry the recorder with me while working. To some extent, the same problems were applicable for the biogas plants, although there were not as many people coming in and out of the plant as there were in the store. I still found it more convenient to write down the discussions that I had, rather than recording them. In both fields, I took photos to make it easier to memorise the events visually. However, the interviews organised via Teams with the experts and managers working in the biogas sector were recorded and transcribed.

All datasets were analysed using Atlas.ti software. The main procedure was the same for all the datasets. First, I read through the data a couple of times and identified the central themes. Then, I started coding the data based on these themes using the aforementioned software. The number of codes varied depending on the dataset: in ethnographic fieldnotes and food waste diaries, there were fewer codes than in the interview material. This results from the fact that in interviews, people may change the topic rather frequently, but when writing ethnographic fieldnotes or collecting food waste diaries, it is easier to define the focus. After coding the data, I organised the codes under titles that represented the wider thematic contexts of each code group under them. When writing the analysis, I created analysis sections based on these wider thematic contexts. I included almost all the codes in the analysis, but emphasised the ones that appeared most frequently in the data.

As I already stated, theoretical ideas and concepts guided the analysis and coding of the data in each article. When analysing the ethnographic material collected from the supermarket, we focused on identifying different practices of preventing and producing food waste, as well as on the ways of framing the products. Here we drew from frame analysis (Callon, 1998; Goffman, 1974) (for a more detailed description, see Article I and Section 6.2). Moreover, the ethnographic material collected from the two biogas plants was analysed by paying special attention to the ideas of assetisation and valuation of biowaste, and both of these concepts draw from the research literature utilised in Article III (for a more detailed discussion, see Article III and Section 6.4). When conducting the analysis in Article IV that examines all the datasets of this dissertation, I focused especially on exploring how situated practices enact different realities (see Mol, 2002) for food waste, and how these practices thus also enact the potential CE futures differently (for a more detailed discussion, see Article IV and Section 6.5). In the following section, I will discuss research ethics.

5.5 Research ethics

All research processes include ethical considerations, and so did my research process. The topic of my research is not particularly sensitive, as it does not contain, for example, information about people's health, political commitment or family relations, nor does it concern especially vulnerable groups. The main ethical questions in my research concerned the issues of informed consent, securing the privacy of the participants and making sure that my research does not cause harm to the business activities of the businesses that participated in the research. Although examining people's behaviour in their homes when collecting food waste diaries involves issues related to securing the privacy of the participants, I did not consider this especially challenging in the context of my research, mainly because the people who participated in this research lived all over the country and not in any specific identifiable location, and I collected and revealed so little background information about the participants that discovering their identities would potentially be very difficult.

When sharing the research call, I secured the informed consent of all potential research participants by providing them with information about the topic and how my research would be conducted. All participants of the research (diary keepers, interviewees and the involved employees at the store and biogas plants) signed a research agreement, in which I provided information about the research and the usage of the data. Some specific considerations concerning informed consent relate to the fact that I conducted ethnographic observation in people's working environments. This was especially evident in the store, where many employees at times seemed to consider me to be one of the employees. I think that in this kind of setting, there is a need to ensure that people understand that they have a right to decline from participating in the research, even if it happens in their workplace. In other words, it is important to ensure that the participants understand that their employer is not demanding them to participate in the research, nor does their 'collegial' relationship to me oblige them to participate. I paid attention to making this clear in the research agreement, and I also verbally expressed to the participants that they had the right to decline from participating.

All individuals and companies that participated in the research have been pseudonymised, and I have not mentioned the exact location of the businesses in my research. I decided not to reveal the company names in the research, even though some of the companies that participated in the research would have preferred to participate publicly. I asked the company management for permission to publish the

photographs that are included in the articles and paid special attention to the fact that it is not possible to identify the businesses from the photographs. Through these actions, I aimed to minimise the risks that my research could potentially cause to the businesses and their employees, although I do not reveal any sensitive information about the employees or the operation of the businesses in my research. In the following chapter, I will provide a summary of the articles in this dissertation.

6 SUMMARY OF THE ARTICLES

In this chapter, I will provide summaries of the articles in this dissertation. In Section 6.1, I will first present the research questions, data and claims of each article in a tabular format. Sections 6.2–6.5 provide broader summaries of the individual articles. Articles I–III have all undergone peer-review processes in different publication outlets, and Article IV is a manuscript submitted to an academic journal. Together, the articles contribute to social scientific waste studies and research on the CE, but they also make individual contributions that are discussed in more detail in the summaries.

6.1 Research questions, data and claims of the articles

Table 2 presents the research questions, data and claims of Articles I–IV. Article I of this dissertation investigates how food products are valued in the Finnish retail sector during the process of ridding and how these valuation practices contribute to framing products in various different ontological categories (food, excess, wastage and waste). Article II analyses how the ethical work of reducing food waste is conducted in households and sheds light on how routinised practices delimit this ethical work. The article also pays attention to how other ethical obligations, such as taking care of children, sometimes overrule the goal of reducing food waste. Article III examines the process of turning biowaste into an asset in Finnish biogas plants and shows how biowaste is unruly matter that participates in and complicates the practices of valuing it. Article IV analyses how transformative practices at all the sites of this study enact different realities for food waste and how these realities simultaneously shape the potential CE futures differently.

Table 2. Research questions, data and claims

Article	Research question	Data	Claim
Article I	How are food products framed and valued in the process of ridding, and how do these practices enact different realities for the products?	Four weeks (120 hours) of ethnographic fieldwork in a supermarket, ethnographic interviews	Different modes of valuing food products may sometimes clash with each other, creating challenges for circular practices → Food waste is not only a managerial problem in the context of the CE. Food waste is rather reduced and enacted in situational practices that always entail leakage and spillover.
Article II	How is ethical subjectivity constituted for reducing food waste in the context of the circular economy?	26 food waste diaries collected from Finnish households, ethnographic observations in four leftover food cooking workshops organised in collaboration with the Finnish Martha Organization and Wastebusters research group	The intertwined CE practices, institutions and policies create moral responsibilities in the everyday life of consumers that require ethical work → The everyday ethical requirements are partly contradictory, and persistent practices delimit the ethical work of reducing food waste. This creates challenges for reducing food waste, thus making food waste an inseparable part of everyday ethical work and domestic practice.
Article III	Through what kind of concrete, hands-on valuation practices may biowaste turn into an asset in everyday operations of biogas plants, and how does waste participate in or complicate these practices?	Three weeks (75 hours) of ethnographic observation in two biogas plants, ethnographic interviews, 11 semi-structured interviews with people working in the biogas sector	Biowaste resists turning into an easily manageable and homogenous mass in the everyday valuation practices in biogas plants; the biowaste mass and reactors have to be constantly taken care of, and it is not sufficiently clear in all situations whether the valuation practices at plants produce value or waste → In the context of the CE, waste valuation practices do not offer perfect control over waste, but waste valuation rather requires careful and respectful alignment with the unruly waste matter.
Article IV	How do different dimensions of the transformativity of practices enact different ontologies for food waste, and how do these ontologies shape the potential CE futures?	26 food waste diaries collected from households, four weeks of ethnographic observation at the supermarket and three weeks of ethnographic observation at two biogas plants	Different dimensions of transformativity of practices enact food waste differently, and these different realities enacted for food waste simultaneously shape the potential CE futures → Multiple potential CE futures are enacted in food waste practices, and these futures are based on partly contradictory rationalities.

6.2 Article I: Food, excess, wastage and waste: An ethnography of the practices of framing food products in the Finnish retail sector

The first article examines the hands-on practices of reducing and preventing food waste in the Finnish retail sector. The article is based on four weeks of ethnographic fieldwork conducted in September 2019 in one supermarket located in one of the largest cities of Finland. The analysis pays special attention to different understandings, practices and framings related to food products in the field. The article draws from frame analysis (Callon, 1998; Goffman, 1974) to analyse how the practices of framing products in different categories enact different realities for them in the process of ridding. The article adapts the pragmatist approach to value as valuation (Dewey, 1939; Muniesa, 2012) and analyses how different modes of valuation (Çalışkan & Callon, 2009, 2010) affect the ways in which products change their status in the process of ridding and how these different modes may also sometimes clash with each other in the everyday operations of the store.

The analysis focuses on the hands-on valuation practices of the store employees that contribute to framing the food products in four different categories: food, excess, wastage and waste. In the article, food refers to products that are sold on shelves. Excess refers to products that are superfluous in one way or another—usually, this means surplus products that are ordered to keep the shelves stacked, and the products may move from this category either back to the category of food or, alternatively, to the categories of wastage and waste. By wastage, we mean products that are circulated through optional routes, such as donating them to the food bank, and waste refers to products that are simply discarded. These different ontological statuses of food items affect how the products are circulated in the store and where they end up.

The article finds that keeping and framing products in the category of food, that is, products that are sold from the shelves and not circulated through any other route, require store employees to carry out constant work and valuation practices. These valuation practices include actions such as organising the shelves, removing spoiled products from the shelves, providing the products with discount stickers and tinkering the products. Simultaneously, to keep the shelves full, the store has to order more products that it actually sells, and here, part of the products inevitably get framed in the category of excess. Excess refers to products that are, in one way or another, supplementary to the products that are sold, but they may still end up back to the category of food or, alternatively, move to the categories of wastage or waste.

In this sense, excess is a liminal category that is spatially underdetermined. Controlled production of excess is crucial for efficient operation of the supermarket—maintaining a wide selection of items and keeping shelves constantly stacked are essential for the competitiveness of the store and keeping customers happy, as long as the economic loss caused by excess is under control. However, the employees work hard to make excess products still valuable, for example, by using surplus fish and meat in ready-made meals cooked in the store; thus, the products can still be moved back to the category of food. However, there is not always enough time to do this; consequently, the excess products that cannot be valued are framed to the category of wastage. Wastage means products that are not sold from the shelves but circulated through optional routes, such as donating them to a food bank or selling them through a 'Food Waste Application' that enables stores and restaurants to sell their surplus products at a reduced price. Circulating products through these optional routes requires valuation practices—products that are donated have to be picked up from the shelves and stored; in addition, for example, fruit and vegetables that are sold through the Food Waste Application have to be sorted and possibly tinkered (e.g. mouldy grapes have to be removed from the gape boxes). It is typical that when the products are moved to the category of wastage, this movement is done spatially by locating them to the 'back room' of the store. Thus, wastage products are concretely separated from food products located in the store. If wastage products cannot be saved from the waste stream through selling or donating, they end up as waste. Waste refers to products that are simply discarded. Here, the alienation of waste products is again enacted very concretely—they are moved to a bin that is located at the loading bay of the store and are thus separated from the wastage products located in the back room, as well as from the food products located in the store.

In addition to showing how valuation practices contribute to framing the products and thus enacting different ontological categorisations for them, the analysis also pays attention to how different modes of valuation clash in the everyday operations of the supermarket. In some cases, the valuation practices stress efficiency and cost-effectiveness at the expense of food waste prevention: the employees engaged in the practices of valuing excess products through cooking ready-made meals only if there was enough time to do it, fruit and vegetable bags to be sold in the Food Waste Application could not always be prepared since it took so much time and excess products were ordered to the store to keep the shelves constantly stacked, even if this led to part of the products ending up as waste. These clashes between different modes of valuation, namely securing efficient store

operations and preventing waste, often led to leakages and disruptions in the practices of circulating the products.

This article contributes to the understanding of how the circularity of food waste is made in practice in the everyday operations of retail businesses. The main contribution of the article is twofold. First, it shows how different modes of valuation may clash in the everyday operations of the store and how these clashes often lead to leakages and disruptions in waste prevention practices. Examining the clashes between different modes of valuation exemplifies the possible tensions between different rationalities when putting the CE in practice in the everyday operations of business, such as retail stores. Second, the article sheds light on how the practices in the store do not simply produce value or waste, but there are multiple categorisations that food products go through in the everyday operations of retail businesses.

On the one hand, understanding the leakages and disruptions in waste management practices shows that food waste is not simply a managerial problem in the context of the CE but is always reduced and produced situationally. On the other hand, the multiple categorisations that the food products go through in the everyday operations of the store illustrate how the practices do not simply produce value or waste and shed light on the complex careers of objects as well as the processes through which food products may end up as waste or something else.

6.3 Article II: Towards a circular economy in food consumption: Food waste reduction practices as ethical work

In the second article, we explore everyday food waste reduction practices in households as ethical work on the self that is necessary for the transition towards a CE. The article analyses 26 food waste diaries collected from Finnish households and participant observation material from four leftover cooking workshops organised in collaboration with the Finnish Martha Organization and Wastebusters research group. The article combines the Foucauldian approach to ethics and practice theory to examine the tensions between the ethical work that aims to transform unsustainable food consumption practices into more circular ones and the persistent everyday routinised practices that delimit this transformation. In the analysis, special attention is paid to Foucault's (1994) four dimensions of ethical work: ethical substance, mode of subjectivation, self-forming activity and *telos*.

Through this approach, the article frames the CE as a moral economy that defines right and wrong ways of acting with waste (see also Gregson et al., 2015).

In the article, we observed that the ethical substance in everyday food waste practices—that is, the part of the self that is perceived to need moral processing (Foucault, 1994)—is related to unsustainable and unethical food consumption practices. The participants often described food disposal with terms that were strongly morally charged: throwing food away was, for example, described as a sin. However, despite the strong moral condemnation of wasteful food consumption, achieving actual food waste reduction was often rather difficult. Routines such as always making too much coffee were deeply rooted in everyday activities.

The mode of subjectivation, which invites people to recognise their moral commitments and refers to the ways in which people consider themselves obligated to put them into practice (Foucault, 1994), could be seen as a commitment not to waste food and thus make food consumption more reasonable. The participants often aimed to modify their food consumption practices by observing their own and other people's behaviours. This happened, for example, through acting as an educator for family members. However, food waste reduction was not the only moral commitment related to food consumption since people need to, for example, take care that the food offered for the family is safe, and sometimes this means that some food has to be discarded. Thus, there needs to be some flexibility in relation to the moral obligation related to not wasting food.

The self-forming activity, which means the techniques that people use to become ethical subjects (Foucault, 1994), became apparent in our analysis through the different kinds of measures that the participants took to disrupt their unsustainable food consumption practices. These measures included, for example, planning meals so that leftovers were utilised when cooking, cooking for children the kind of food they like and eating their leftovers and sometimes even eating spoiled food to prevent it from ending up as waste. Not all techniques in the self-forming activity were, however, related to preventing food waste—practices of disposing, cleaning and separating the self from spoiled food were also part of the process of becoming an ethical subject. In this sense, food waste production was sometimes accepted as part of everyday ethical work.

Finally, the *telos*, that is, the ultimate goal of moral behaviour (Foucault, 1994), was not often stated very clearly in our data, but it was rather connected to several different issues: care of distant others who may not have enough food, climate change and emotional commitments related to food. Based on this, the *telos* of the

moral behaviour of reducing food waste could be seen as an aim to become a good citizen in the context of the CE by avoiding food waste and recycling it.

The main contribution of Article II is to illustrate the moral complexity of everyday life and how different moral commitments may clash with each other in the everyday life of consumers. For example, the moral aim to be a good parent by providing the children with diverse food and not pressing them to eat too much often overrides the aim to completely prevent food waste. In addition, the article contributes to practice theoretical research on consumption (see, e.g. Shove & Pantzar, 2005; Warde, 2005) by paying attention to ethics in the context of performing everyday consumption practices. The article argues that, from the viewpoint of the consumption practices of individual consumers, the CE cannot be perceived as a moral economy of simple 'rights' and 'wrongs'. In line with previous research in the field of social scientific waste studies, this article points out that practices of disposal and generating waste are an inseparable part of domestic practice (Evans, 2012a), and it is thus not possible to completely end waste production, as attempted by some of the most optimistic CE visions.

6.4 Article III: Biowaste as fluid matter: Valuing biogas and biofertilisers as assets in the Finnish biogas sector

Article III examines the hands-on making of the circularity of biowaste in Finnish biogas plants. The research materials comprise a three-week ethnographic observation conducted in two biogas plants and 11 interviews with managers, CEO's and experts working in the biogas sector. The article focuses on the assetization (Birch & Muniesa, 2020) of biowaste, that is, the process of turning biowaste into valuable biogas and biofertilisers. We combine the pragmatist approach to value as valuation (Dewey, 1939; Muniesa, 2012) with new materialist and posthumanist approaches (e.g. Barad, 2007; Bennett, 2010) to explore how waste participates in and complicates the practices of valuing it. In this article, biowaste is conceptualised as *fluid matter*. This conceptualisation suggests a reorientation to the materiality of waste; instead of focusing on biowaste as a clear-bounded object, we turn our attention to the unruliness of waste matter.

In the analysis, the hands-on making of circularity is analysed by focusing on the valuation practices that contribute to running and sustaining the biogas production process, thus aiming to transform biowaste into assets, namely biogas and fertilisers. We found that first, when biowaste arrives at the plants, it has to be turned into a

homogenous mass; it is thus enacted as a less-than-object (Pyyhtinen, 2015). This means that its characteristics as a clear-cut object are stripped off, and it is turned into a fluid and unruly mass. However, at the same time, biowaste cannot be turned into a completely homogenous mass, and here, the fluidity of biowaste becomes apparent. Biowaste collected from households, retail stores and food industry businesses contains a lot of different contaminants, such as plastic and metal packaging; thus, valuing it is rather complicated since different contaminants can, for example, block pipes and gather inside biogas reactors.

After biowaste is pretreated and turned into a more or less homogenous mass, the process needs to be taken care of. The temperature of the slurry has to be monitored, and biowaste needs to be kept separate from other feedstock materials, namely sewage sludge. This illustrates that, while biowaste is fluid matter with unclear boundaries, the process of valuing biowaste is still not completely devoid of any boundaries. In addition, when running the process, plant workers need to be careful not to intensify the feeding too much and take care that different substances do not cause too much foaming inside the reactors. In the worst case scenario, unsuitable substances fed to the reactors may even completely kill the process or cause so much foaming that the foam ends up in the pipes through which gas is transported. If the foam gets to the pipes, it may break down expensive parts of machinery that are not easily available. Thus, taking care of the process does not offer perfect control over waste matter and requires respectful attunement with waste and the machinery of the plant (Heuts & Mol, 2013).

When biowaste is turned into new assets, that is, biogas and fertiliser, the plants need to distribute and sell these products, and doing this is rather difficult: the investments in the infrastructures needed to efficiently distribute the gas are really expensive, and creating monetary value for fertilisers is also difficult owing to the underdeveloped markets in Finland. Because of these issues, the plants sometimes need to burn excess gas through a torch or give the fertilisers away for free and even pay for the freight in some cases. Thus, biowaste that has now been transformed into biogas and fertilisers is more-than-object (Pyyhtinen, 2015); it is completely entangled with, for example, energy policy and agriculture. The different rationalities and operating logics of these sectors condition the possibilities of distributing and creating monetary value for the gas and fertilisers produced. Resulting from these issues, and despite the material transformation that biowaste goes through in plants, the biogas production process does not completely manage to remove the nature of these end-products as problematic excess. Here, the fluidity and unclear boundaries of biowaste once more become apparent. However, this is not to say that the issues

related to valuing the end products could not be potentially changed in the near future, as the current energy crisis in Europe has already shown. Thus, the fluidity of matter does not only have to do with biowaste, biogas and fertilisers but also more generally with the shifting line between waste and value/price.

Article III contributes empirically to social scientific waste studies and scholarship on the CE by showing that high-level CE discourse inadequately recognises that waste valorisation is not only about more efficient controlling of waste matter; it also requires alignment with waste and its different qualities. These qualities may sometimes cause unexpected consequences, and waste does not always act as desired. In addition, the article contributes to theoretical discussions on materiality by breaking things open through its focus on biowaste as fluid matter instead of a clear-cut object. Shifting focus away from solid objects enables one to attend better not only to flows and fluidities but also to the entanglements of different materials. It also makes it possible to better examine the complexities of waste management and other systems.

6.5 Article IV: The circular economy futures in the making: Transformativity and object ontologies in food waste practices in Finnish households, supermarkets and biogas plants

In Article IV, I utilise all the datasets I gathered for this dissertation to analyse the transformativity of food waste practices. With the transfromativity of practices, I refer to the future-in-the-making aspect of practices, that is, the precarious enactment of different futures in the present moment (Meskus & Oikkonen, 2020) that aims to change both the practices and the materials entangled with and within the practices. This article draws from Mol's (2002) praxeological methodology to examine how different ontologies are situationally enacted for food waste and future-oriented practice-based research (Mandich, 2020; Welch et al., 2020) to analyse the future projectivity of practices. In the article, I conceptualise three different dimensions of the transformativity of practices: habitual transformativity, planned transformativity and experimental transformativity. I pay specific attention to how these different dimensions of transformativity simultaneously enact both food waste and the potential CE futures differently. In addition, I highlight how the different dimensions of the transformativity are based on different rationalities.

In the analysis, I observed that through habitual transformative practices, that is, ordinary habits that do not require much deliberate effort to avoid wasting food and

that are experienced as useful in food waste reduction, food waste is ontologically enacted as a problem to be prevented. This means that food waste is seen as something that should be completely avoided and that biowaste is seen as something that should always be valued. In households, this usually meant that the participants had formed several habits that helped them prevent food waste, such as going to the store often or always cooking certain meals to make it easier to buy a suitable amount of food. In these practices, the participants formed an attitude towards a CE future in which food waste should not occur at all. For supermarkets, habitual transformativity was most clearly apparent in the normative goal of preventing food waste in the everyday routines that employees perform daily. This prevention entailed practices such as always organising the shelves so that old products were placed at the front of the shelves and new products to the back so that the soon-expiring products would be sold first to avoid food waste. In biogas plants, habitual transformativity simply meant the routinised running of the biogas production process, such as regular maintenance work that aims to secure the smooth operation of the machinery. The goal of these practices was that biowaste would not be left unutilised and that it would be smoothly transformed into new products. In habitual transformative practices in all the examined environments, the CE future enacted was based on the idea that food waste should be completely avoided. Thus, habitual transformative practices are based on the rationality of frugality.

Planned transformativity of practices refers to planned actions based on calculative leaning to probabilities (see also Thévénot, 2001) and deliberate aims to change practices. In these practices, food waste is ontologically enacted as a utilisable object. This means that the practices aim for material and economic efficiency through utilising and preventing food waste. In household practices, this usually refers to planning, shopping and cooking so that food waste would not be produced. The participants also aimed to prevent food waste from occurring outside the home. They, for example, bought discounted products from supermarkets and dumpster-dived to utilise retail food waste and save money. In supermarkets, planned transformativity meant strategies developed to prevent food waste, such as using and developing technologies that enable stores to track their food waste. In the supermarket, the practices did not strive to completely avoid food waste since securing product availability requires that slightly too many products are ordered to the store. Rather, the practices aimed to keep food waste production under control. The store aims to get rid of surplus products, for example, by utilising discount stickers and selling excess products through optional routes, such as mobile applications. Thus, the planned transformativity of practices in supermarkets is not

only based on the aims of ending the production of food waste but also on creating means to distribute the produced waste. In biogas plants, planned transformativity means securing the competitiveness of the business by offering competitive prices for the waste management services that the plant offers. Since the competition between plants for biowaste is fierce, it is a scarce resource for biogas plants, and according to some participants, in the future, it may even turn into a commodity that plants have to pay for. When the planned transformative practices at homes, supermarkets and biogas plants enact food waste as a utilisable object, they simultaneously enact a CE future that is not based on the idea that food waste should be completely avoided but that it should be rather utilised in one way or another. The practices are thus based on the rationality of utility.

Experimental transformativity means innovative practices that are projected towards hardly imaginable CE future visions that may or may not be realised. In experimental transformative practices, the outcome of practices is often unclear, and through these practices, food waste is enacted as an object of speculation. This means that it is more or less unclear what food waste may turn into and what kind of effects it may have in the future. In households, experimental transformativity often entails creativity, such as inventing new recipes from leftovers. These experiments may sometimes fail, or sometimes they may turn out to be successful. In supermarkets, experimental transformativity refers especially to the creative utilisation of surplus products in new products, such as ready-made meals sold in the store. Experimental transformativity can also mean inventing and marketing completely new products created from leftovers and testing whether consumers accept them. Through this kind of marketing, stores can increase their visibility and highlight their efforts in reducing food waste. In biogas plants, experimental transformativity means testing new possibilities for utilising biowaste, such as creating liquid fertiliser from the excess water that is created in the biogas production process. It is, however, unclear whether the products will be suitable for certain uses and whether there is demand for these products; thus, these practices are often very precarious. In all the examined environments, when food waste is enacted as an object of speculation, one has to accept different possible outcomes and adjust the practices through trial and error. The CE future that is simultaneously enacted is based on accepting the fact that food waste and biowaste cannot always be perfectly managed and turned into what people would want it to be (see also Article III), and here the practices are based on the rationality of innovation.

Through its analysis of the different dimensions of transformativity of practices, this article shows that when different ontological statuses are enacted for food waste

(Mol, 2002), potential CE futures are simultaneously enacted differently. Thus, there exist multiple potential CE futures (see also Meskus & Oikkonen, 2020) that are based on partly contradictory rationalities—for example, the rationality of frugality highlights the need to avoid food waste, whereas the rationality of utility does not necessarily aim to avoid all food waste in the future. The article contributes empirically to research focusing on the CE as a matter of everyday actions by offering a systemic viewpoint to food waste practices by analysing the practices within the end parts of the food chain. Moreover, the article contributes conceptually to future-oriented practice-based research (Mandich, 2020; Welch et al., 2020) by conceptualising the three dimensions of the transformativity of practices. By doing so, the article suggests that a focus on the different dimensions of transformativity of practices and their rationalities can offer one possible avenue for practice-based research to better articulate how the changing goals of practices shape societal transformations and futures, for example, the CE.

7 DISCUSSION

In this final chapter, I discuss the findings and contributions of this dissertation. In Section 7.1, I outline the main contributions of this research to social scientific waste studies and research on the CE. I also suggest some policy implications. Section 7.2 explains how the individual articles answer the sub-questions of this study and how the articles together answer the main research question. I also discuss the contributions of the individual articles from the viewpoints of ethics, valuation and future of food waste. In Section 7.3, I analyse the limitations of this study and provide some suggestions for future research. In Section 7.4, I draw a conclusion.

7.1 Contributions to social scientific waste studies and research on the circular economy

As a whole, this dissertation contributes to discussions in social scientific waste literature and in research concerning the CE. Although I do not find it convenient to strictly classify how different aspects of this study distinctively contribute to these two partly overlapping fields, I want to highlight how some aspects of this research are specifically important from the viewpoint of each of these two fields of research.

The main contribution of this research to the field of social scientific waste studies is an empirical one: this study follows the changing ways of dealing with and relating to waste across the end stages of the food chain. Social scientific waste studies have often been interested in ways of living with waste and sharing our lives with it (see, e.g. Hawkins, 2006; Valkonen et al., 2019). Although there already exists both ethnographic research (see, e.g. Gille, 2001; Laser, 2020; Reno, 2009) and studies focusing on the socio-material practices of handling waste in the field of social scientific waste studies (see, e.g. Gregson, 2007; Hawkins, 2006, 2012; Kinnunen, 2021), there is not much previous research that follows the hands-on practices of dealing with waste at multiple sites across the production–consumption system. Analysing concrete practices at different nodal points in the food consumption process enabled me to follow how waste is enacted differently in the varying practices at different sites. It would not have been possible to analyse this to

the same extent, for example, through the utilisation of interview data or documents. Understanding the different ways of enacting waste in concrete practices at different sites reveals something important about the ways of relating to waste in different settings. From the sociological perspective that this dissertation employs, food waste is not simply an environmental problem, moral issue or a cause of economic loss, as the public and scholarly discussion often frames it. This dissertation has shown that food waste may have multiple other realities and meanings (it can be, for example, a resource, an inseparable part of ethical work on the self or necessary evil from the viewpoint of efficient business operations), depending on the ways in which it is performed in practices and the relations with which it is situationally entangled.

The most important contribution that this dissertation makes to the research on CE is that it follows how food waste is circulated in practice and highlights how potential leakages and disruptions in this circulation occur at different sites of the study. A growing body of research on the CE has been paying attention to the difficulties of circulating waste in practice (see, e.g. Gregson et al., 2015; Hobson et al., 2021) and the leakages and disruptions in the circulation of waste (Holmberg & Ideland, 2021). The distinctive contribution of this dissertation in relation to these previous studies is that my study highlights how practices and food waste change along the food chain and how the CE is simultaneously always enacted and complicated differently. In addition, this research highlights that in the context of the CE, people cannot arbitrarily decide what waste becomes, but waste always affects the practices of valuing and circulating it (Article III). Previous research focusing on the CE has shown that the CE definitions are unclear and that the CE concept means different things to different actors (Corvellec et al., 2022; Kirchherr et al., 2017). The hands-on approach adopted in my study has enabled me to highlight how this messiness, lack of straightforwardness and unclarity related to the CE becomes apparent not only in different ways of defining the CE but also in practice.

This study also has some policy-related implications concerning the CE. By taking the socio-material practices of dealing with waste as the core of the research, my dissertation shows that we cannot understand the possibilities and obstacles of the CE transition if we do not take the different entanglements of waste materials and related practices seriously. Food waste is thoroughly entangled with partly contradicting rationalities, policies, goals, ethical sensitivities and material relations, which all complicate the possibilities of making food waste circular. The policy discussion concerning the CE transition could benefit greatly from adapting the viewpoints that social scientific waste studies and the practice-based approach offer.

For example, to draw a realistic and more comprehensive picture of the possibilities of circulating different types of waste in practice, it would be important to better understand the different and changing material qualities of waste, the ways in which people relate to different kinds of waste and how they deal with them in their everyday practices. One could, for example, ask how the current CE policies reach the ways in which we can relate to and deal with nuclear waste or other types of hazardous waste. Such questions could also set interesting paths for future research. In the following section, I will exemplify the contributions of the individual articles of this dissertation to discussions on the ethics, valuation and future of food waste, and show how I have answered the research questions of this study.

7.2 The contributions of the articles to discussions on the ethics, valuation and future of food waste

In this section, I will first discuss how the individual articles answer the sub-questions of this study and how they contribute to discussions on the ethics, valuation and future of food waste. I will then show how the articles together answer the main research question of the dissertation. In Article I, we examined how valuation practices at supermarkets contribute to the production and reduction of food waste. The first sub-question of this dissertation—*How are food products framed and valued in the process of ridding, and how do these practices enact different realities for the products?*—is answered in this article by focusing on the mundane routines in the supermarket that contribute to valuing the products and creating the circulation of food waste. As I already showed in section 6.2, store employees organise the shelves daily so that the soon-expiring products will be sold first; in addition, they adapt product orders based on the demand for particular products, perform a lot of hands-on work to sort expiring products to be donated to a food bank or sold via the Food Waste Application, work hard to utilise excess products, such as leftover meat in the meat counter, and discard products that cannot be sold or otherwise utilised anymore. These practices contribute both to valuing food products and framing them to different categories, namely, food, excess, wastage and waste. The products are framed to these categories through different modes of valuation: food products are framed and kept in the category of food by organising the shelves so that the products are sold before they spoil, excess is produced when too many items are ordered to the store to keep the shelves constantly stacked, wastage products are distributed through optional routes, such as donating, and waste occurs when

products are simply discarded. When the products are framed into these different categories, their circulation is thus always constituted differently.

Article II studied how consumers do ethical work to reduce food waste. The article answers the second sub-question of this dissertation—*How is ethical subjectivity constituted for reducing food waste in the context of the circular economy?*—by focusing on how consumers have adopted the CE as their moral project by aiming to reduce food waste. As I previously discussed in Section 6.3, to analyse the ways in which ethical subjectivity is constituted, the article focuses on the four dimensions of ethical work (ethical substance, mode of subjectivation, self-forming activity and *telos*). Through these different dimensions of ethical work that entail practices, such as efforts to curb wasteful food consumption, teaching family members to reduce food waste and cooking from leftovers, the participants aim to become good citizens in the context of the CE. At the same time, several different ethical requirements have to be taken into account in this everyday ethical work; thus, the ethical goal of reducing food waste and becoming a good citizen in the context of the CE may sometimes be overruled by other goals.

In article III, we analysed how food that has been turned into biowaste is transformed into valuable assets, namely biogas and fertilisers, in biogas plants. The article answers the third sub-question of this dissertation—*Through what kind of concrete, hands-on valuation practices may biowaste turn into an asset in everyday operations of biogas plants, and how does waste participate in or complicate these practices?* The article answers this question by analysing the everyday routines and biowaste valuation practices at the plants, such as maintenance and running and monitoring the production process. Consequently, as I highlighted in Section 6.4, the article shows that to value biowaste, waste has to be first turned into a more or less homogenous mass through the pretreatment process, and this mass has to be constantly taken care of through monitoring and adjusting the feeding. After the completion of the biogas production process, in which waste is turned into new assets—that is, biogas and fertilisers—these end products have to be distributed in one way or another. Biowaste participates in and complicates its valuation practices, for example, by presenting difficulties in turning into a completely homogenous mass that would be easy to value and by causing foaming and overflows in the reactors. In addition, valuing the end products is also rather difficult, as farmers are unwilling to pay for fertilisers and distributing biogas requires expensive infrastructure investments.

In Article IV, I studied all the datasets used in this dissertation and explored how different CE futures are enacted in food waste practices. The article answers the fourth sub-question of this dissertation—*How do different dimensions of the*

transformativity of practices enact different ontologies for food waste, and how do these ontologies shape the potential CE futures? The article answers this question by paying special attention to how the different dimensions of transformativity of practices (habitual, planned and experimental) enact different ontologies for food waste and how this shapes potential CE futures differently. As I discussed in Section 6.5, through habitual transformative practices, food waste is enacted as a problem to be prevented; thus, the practices constitute a CE future in which food waste should not occur at all. In planned transformative practices, food waste is turned into a utilisable object, and here, the practices are projected towards a CE future in which food waste does not have to be completely avoided but rather utilised as efficiently as possible. Experimental transformative practices enact food waste as an object of speculation and thus they create a CE future that is rather unclear or hardly imaginable.

All the articles in this dissertation contribute to social scientific waste studies and the research on CE. However, they also contribute to discussions concerning the ethics, valuation and future of food waste. Article I especially contributes to the understanding of how food items may have multiple possible realities in the process of ridding, and how these different ontological statuses of food items are produced through valuation practices. Thus, the article adds knowledge, especially about the different possible categorisations of food waste, and how different modes of valuation contribute to moving products between these different categories. Consequently, this article shows that different categorisations of food items affect the ways in which they are dealt with and valued. Article II analysed the ethical work of reducing food waste. This article contributes to the understanding of the ethics of food waste by showing that the ethical work of dealing with food waste cannot be understood only through simple 'right' and 'wrong' ways of acting. By highlighting the nuances in the ethical work of reducing food waste, the article complicates the understanding of food waste as an ethical problem. Article III focuses on how biowaste is valued in the practices of biogas plants. It shows that it is not always clear whether the practices of valuing biowaste produce valuable assets or problematic excess, as well as how the success of the valuation practices at the plants is always dependent on the broader societal end economic contexts that may also sometimes unexpectedly change. Thus, the article underlines that the CE discourse of turning waste into value sometimes simplifies the unruliness and fluidity of biowaste, biogas, fertilisers and value itself. Article IV analysed how different potential CE futures are enacted through the simultaneous enactment of different realities for food waste. The article contributes to the understanding of the future of food waste by showing that multiple potential CE futures are produced in food waste practices; thus, it is

not always perfectly simple or straightforward what kind of a CE future the practices in fact constitute. The article especially highlights how CE futures are entangled with different, sometimes contradictory, rationalities.

All the articles together answer the main research question of this dissertation—*How do everyday practices contribute to enacting and complicating both food waste and the circular economy, and how does food waste itself participate in forming these practices?* The articles, as a whole, answer the first part of the main research question, whereas Article III especially answers the latter part of the main question. However, to some extent, all the articles in this dissertation answer the latter part of the main question by highlighting how the material qualities of food, such as its tendency to spoil, affect the practices of dealing with food waste. Together, the articles focus on very different environments at the end stages of the food consumption process and reveal the changing ways of dealing with and relating to food waste in these environments.

Article I highlights, in particular, how mundane supermarket practices contribute to enacting the CE of food waste. This happens mainly through constant practices that aim to minimise food waste, such as organising the shelves, using discount stickers, donating food waste and adjusting product orders based on demand. However, these practices also situationally complicate the CE and simultaneously contribute to enacting food waste. According to our study, the most apparent issue complicating the CE of food waste is that the store needs to secure efficient store operations and product availability. This became apparent, for example, in situations when food waste was utilised only if there was enough time, as well as through the fact that controlled food waste production was accepted as an inseparable part of the store's operations. The practices also complicated food waste itself: the valuation practices did not simply produce food or waste, but the products were rather situationally framed in and moved between various categories, namely, food, excess, wastage and waste.

Article II answers the main research question by examining how the everyday ethical work of reducing food waste, such as cooking from leftovers or planning shopping, contributes to enacting the CE of food waste. However, the partly contradictory ethical requirements of everyday life and persistent routines occasionally lead to food waste production at homes. In fact, some of the food waste, such as the waste that occurs when children do not eat all the food on their plates, was accepted as a normal part of everyday life by several research participants. Through such issues, everyday practices at homes contribute to both enacting food waste and complicating the CE. Further, the practices also complicate food waste itself through the situationally changing ethical sensitivities related to it. The research

participants often saw food waste as a problem that should be prevented because of the multiple issues it causes. Regardless of this, sometimes disposing of food and thus separating the self from disgusting spoiled food items was part of the practice of forming the ethical self (see also Hawkins, 2006). Some participants, for example, shared that, on some occasions, practices such as cleaning the fridge and throwing away spoiled food felt good. This illustrates that there is not just a single possible way of living ethically with food waste; there are also practices, such as disposal, that are an inseparable part of forming the ethical self in relation to food waste.

In article III, the main research question is answered by analysing how the practices of biogas plants contribute to enacting the CE by turning waste into a resource and producing valuable products from it. In addition to producing biogas and fertilisers, plant managers and employees constantly work to develop and test new uses for biowaste and the side streams of the biogas production process. The practices at biogas plants, however, also complicate the CE. Since it is not always financially possible for plants to build infrastructures that would enable them to distribute the gas produced efficiently, it sometimes has to be burned through a torch. Additionally, for example, during the summer, there may not be enough demand for the gas for heating purposes. The fertilisers produced are also often given away for free due to the underdeveloped markets in Finland. The difficulties of turning biowaste into assets show how biowaste participates in and complicates the practices of circulating it. Biowaste resists turning into an easily manageable mass, and it is difficult to make the end products produced from it valuable. Here, the article particularly answers the latter part of the main research question. The analysis focusing on the valuation of biowaste in Article III also very concretely shows how everyday practices in different sectors contribute to complicating both waste and the CE: biowaste treated at the plants contains a lot of different contaminants, such as plastic and metal packaging, and this makes it more difficult to turn biowaste into a valuable product.

Article IV exemplifies how transformative practices at different sites, such as food waste reduction at homes and supermarkets and turning biowaste into a resource at biogas plants, contribute to enacting the CE. In addition, instead of only pointing out how the practices complicate the CE and food waste, the article also shows how both food waste and the CE future enacted in practices are in themselves complicated and multiple. That is, there is neither a single ontological reality for food waste nor a single CE future that the practices enact. Rather, several different realities of food waste and multiple potential CE futures are enacted in these practices. In

the following section, I will discuss the limitations of this research and provide suggestions for future studies.

7.3 Limitations and future research

Similar to all research, this dissertation also has its limitations. The first limitation is that the thesis focuses only on the end stages of the food chain, thus completely leaving out, for example, producer food waste. The agriculture sector could have been an interesting research field, especially because producer food waste is connected to retailer practices and quality standards. In addition, agriculture utilises the fertilisers produced in biogas plants. This link became very apparent during my fieldwork, especially in Western Biogas LTD. In Western Biogas LTD, I joined a haulier who worked as a subcontractor for the plant on some of his trips to farms to supply fertilisers for farmers. However, due to the need to define the focus of this research, I was not able to fully focus on this interesting link between farmers and biogas producers during my observation periods in the biogas plants. Overall, farms are still an interesting and focal nodal point from the viewpoint of the CE of the food system. Thus, it would be an especially interesting path for future research to observe farmers' practices to gain knowledge of the role of primary producers in the CE transition of the food system. In this dissertation, the link between biogas plants and farmers is briefly addressed in Article III, but the article does not entail empirical fieldwork conducted in farms.

The second limitation of this research is related to multi-sited ethnography and its design in this dissertation. When focusing on the practices related to food waste at the different sites of this study, I did not follow the movement of food waste between the sites. For example, I did not analyse how food waste concretely moves from supermarkets or homes to biogas plants. Rather, I focused only on the practices that take place within each site of the study. Focusing on these movements of food waste could offer interesting information about the practices of circulating waste, not only within homes, supermarkets or biogas plants but also across and in between different sites. Especially in the 'Global North' context, it is often just assumed that waste will disappear once we take it to the bin. Thus, it would be important for future research to make it visible that moving waste between different sites, such as from homes or supermarkets to biogas plants, requires a lot of hands-on work.

The third limitation of this study relates to the temporal dimension and the amount of data. Conducting ethnographic fieldwork at multiple sites restricted the

amount of time I was able to spend in each field. To produce a more nuanced ethnographic fieldwork, it would have been interesting to, for example, go to a supermarket or biogas plant in short intervals over several years. This would have enabled me to follow in more detail how the practices change over time and how, for example, different policies and global events affect the operations of these businesses. Most importantly, the energy crisis and inflation that hit Europe in 2022 after the Russian invasion of Ukraine currently strongly affects the retail and biogas sectors, as well as consumers. Due to the crisis, the prices of food, energy and fertilisers have significantly increased. These prices affect consumer and retailer practices, and rising energy and fertiliser prices change the markets for biogas and fertilisers. Since my data collection was conducted during a certain period, I have not been able to follow how such events have affected the practices at the sites of this research. It is, however, also rather difficult and resource-consuming to conduct ethnographic research that would take such temporal and contextual changes properly into account. A case study that would utilise different datasets to examine how changes in CE policies together with global events affect the practices of different actors in the food system could thus provide an interesting path for future research.

The fourth and final limitation that I wish to highlight here is that this dissertation focuses exclusively on the Finnish national context related to food waste and the CE transition. Although Finland is an EU country and the Finnish context is thus also internationally relevant, this thesis still very strongly emphasises a so-called Global North perspective on food waste and the CE. To name a few issues related to this, it is typical for this context that a large variety of different food products are always easily available for consumers (at least for those who have money to purchase them). There also exist wide-ranging and well-functioning cold chains that make it possible to safely store large amounts of food in stores and homes across the country and the waste management system is efficient and viable. It is apparent that this is not the everyday reality for many people globally and that these issues strongly affect practices related to food consumption and food waste management. Thus, it would be important to conduct ethnographic studies on food waste practices in contexts other than the 'Global North' as well. In the following section, I will draw a conclusion of this study.

7.4 Conclusion

In May 2022, when I had just started writing this integrative chapter, the Finnish Innovation Fund Sitra published a study titled *Tackling root causes – Halting biodiversity loss through the circular economy*. According to this study, CE interventions in four key sectors—food and agriculture, textile, construction and forestry—can reverse the decline of biodiversity and help it recover globally to the same levels as in the year 2000 by 2035 (Forslund et al., 2022). The research was noticed by a prominent Finnish newspaper, Helsingin Sanomat, among others. Although I was happy to see that the study highlighted the need for a shift towards consuming alternative proteins instead of meat, reducing food waste and cutting down the consumption of textiles, among other things, the communication about the implementation of these rather radical changes in the current patterns of consumption and production left me a bit confused. For example, in Sitra's own communication about the study, it was highlighted that the CE offers solutions to biodiversity loss that are 'ready to be used', and that substituting meat with alternative proteins and reducing food waste are solutions that have the most impact and 'that people can easily adopt' (Lehtinen, 2022). Reading this almost felt as if I had been living in some kind of alternative reality for the past four years while conducting my PhD research.

This thesis has shown that adopting food waste reduction practices at different nodal points in the food system is often anything but easy or straightforward, and in the context of my research, this is not a problem resulting from ignorance or reluctance to adopt these practices. Rather, it is a problem resulting from complex societal and situational socio-material relations that do not always favour waste reduction but sometimes lean towards quite the opposite. It is important to acknowledge that the CE transition has not yet properly taken place and that developments are constantly happening in the field. This relates to the domestication of technologies (Lehtonen, 2003)—new technologies, such as CE practices and infrastructures, will always have to be fitted into the already existing reality, and they will become an integral part of everyday life only through tests and trials. My aim in this dissertation has not been to state the obvious by highlighting that CE practices are still incomplete; practitioners working in the field are already well aware of this. What I wanted to achieve instead was to complicate and unpack some ideas that often come up in the discussion concerning the CE, its implementation and its potential in tackling sustainability issues. These frequently repeated ideas seem to

hold on to a rather top-down managerialistic[9] assumption that we can give people ready-made CE solutions, that they will just adapt them and that after this, our goal of finally eliminating waste from the system will be met.

In light of the practice-based approach of my research, this kind of managerialistic approach to the CE transition seems overly optimistic. Ultimately, this study has shown that there is no CE without the everyday practices that always enact both food waste and the CE differently depending on the situation, and that the everyday practices of circulating and reducing waste do not offer complete mastery over waste materials. Thus, the CE enacted in practice is much more ambiguous than what one would probably assume from the surface. But one may still ask, *Why is this all so important?* My answer to this question is that being overly optimistic when formulating alternatives to our unsustainable economic system is dangerous. The consequences of our current way of life are fatal, and if we are to solve this, we have to approach this alarming problem in a way that takes the complexity of everyday practices, mundane materials and their qualities and entanglements seriously. If we truly want to *enact* a sustainable economy, the policies formulated to achieve this goal cannot be based only on managerialistic steering but rather explicitly acknowledging that we need to be ready to change our way of life as a whole, give up certain things and humbly admit that not everything can always be controlled. This does not necessarily mean that we have to suffer and atone for our sin of being too wasteful, but perhaps we can get something good in return instead.

[9] For further discussion and critique of the managerialisation of the CE transition, see e.g. Rask (2022)

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PUBLICATIONS

PUBLICATION I

Food, excess, wastage and waste: An ethnography of the practices of framing food products in the Finnish retail sector

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Food, excess, wastage and waste: An ethnography of the practices of framing food products in the Finnish retail sector

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ABSTRACT

The reduction of consumer and retail food waste is crucial for the transition towards a circular economy to take place. Based on an ethnography conducted in a supermarket in Finland, the article examines the hands-on practices of producing and preventing food waste in the retail sector, with a focus on the practices of framing and valuing products. We pay special attention to the process of ridding, which our analysis shows to be integral to selling food products and thus creating value. The findings shed light on how different modes of valuation, both monetary and non-monetary, related to the food products sometimes clash with each other in the everyday operations of the retail business, creating challenges for circular practices. Moreover, the analysis also brings to light how the supermarket practices do not only produce food or waste, but the categories of surplus food are much more varied and subtle. We claim that understanding the multiplicity of these categories, their enactment and mutual relations, and the different modes of valuation related to them is crucial for understanding how and why food waste is generated in the retail sector. Our analysis shows that rather than being only a managerial problem in the context of the circular economy, food waste is always enacted and unmade situationally, through constant hands-on work that also entails leakage and spillover.

1. Introduction

As part of the circular economy (CE) strategy of the European Union, the EU countries are committed to the Sustainable Development Goal, which aims to halve the per capita food waste at the retail and consumer level by 2030 (European Commission n.d.). At the same time, however, the production of food waste has become somewhat normalised on a large scale in industrial countries; business operators and consumers alike consider it regrettable yet more or less normal and unavoidable (Devin and Richards 2018; FAO, 2011). There is research done, for example, on the main causes of retail food waste (Alhonnoro et al. 2019; Goodman-Smith et al. 2020; De Moraes et al. 2020) and on the managerial practices that aim to prevent it (Moser, 2019)). However, less is known about the mundane situated rationalities and valuations folded into the practices of producing and preventing food waste in retail stores. In this article, we will examine food waste reduction and production practices in a Finnish retail store from a sociological perspective by focusing on the ways of framing products as waste or not-waste and on what kind of realities the supermarket practices enact to the items themselves.

The research is based on a fieldwork conducted for one month in a Finnish supermarket in September 2019 and on ethnographic interviews done during the fieldwork. Finland provides an interesting context for this research since the country is striving to be a pioneer in the implementation of the CE (Finnish Ministry of The Environment n.d.), and the Finnish retail industry participates widely in voluntary actions to enhance material efficiency and reduce waste (Finnish Commerce Federation n.d.). In this article, by focusing on the everyday practices related to food waste in the retail sector, we aim to contribute to the growing body of research exploring the transition towards the CE as a matter of everyday actions (Hobson, 2016; Lehtokunnas et al., 2020; Mylan et al., 2016; Schulz et al., 2019). Informed and inspired by social scientific waste studies (e. g. Douglas 1966; Thompson 1979; O'Brien 1999; Gregson et al. 2007; Lucas 2002), we pay special attention to ridding as a gradual process (Lucas 2002; Evans 2012) in which the products are framed (Goffman 1974; Callon 1998) in and move between four different categories: *food*, *excess*, *wastage*, and *waste*. We examine what kind of modes of valuation (Çalışkan and Callon 2009) these different framings entail, and how the modes sometimes compete or clash with each other. Our analysis draws from the pragmatist idea of

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value as valuation (Dewey 1939; Muniesa 2012; Helgesson & Muniesa 2013), according to which value does not lie inherently in the objects, but it is enacted and produced in hands-on practices.

Research concerning food waste in general and retail food waste in particular has mainly, but not exclusively,[1] been rather separate from the scholarly discussions concerning the CE. However, as consumer and retail food waste reduction is perceived as part of the transition towards the CE in the food system (Luke, n.d.), it is important to establish a connection between these two discussions. The CE is often defined as an alternative to the unsustainable linear economic model of take-make-use-dispose. There is a lack of a clear and commonly accepted definition for the CE (Merli et al., 2018). In this article, we use the definition provided by Geissdoerfer and others, who define it as 'a regenerative system in which resource input and waste, emission, and energy leakage are minimized by slowing, closing, and narrowing material and energy loops' (Geissdoerfer et al., 2017, p. 759). Thus, in our analysis, we focus especially on practices that aim to minimise waste by, for example, optimising purchases and tinkering the products to make them more desirable to avoid discarding them. At the same time, we also bring out situations where these practices fail. Waste prevention is far from perfect, but it is constantly subject to spills, leakages, and disruptions.

The management of food waste is a crucial part of the retail sector and the business operations of supermarkets (Filimonau and Gherbin 2017). Food waste is often defined as food that is intended for human consumption but discarded instead (Parfitt et al. 2010). However, in the retail sector, the understanding of food waste is slightly different, as it usually refers especially to products that are unsellable from the shelves (Teller et al. 2018). Thus, not all food waste emerging from retail operations refers to food that is discarded, since retail food waste can be donated or otherwise utilised in the store. Given this slight ambiguity of the definition of waste in the retail sector, it is interesting to make visible the different framings and values that may be enacted to the products in the everyday practices of producing and preventing waste, and this is exactly what this article does.

The article is organised as follows: first, we will present our theoretical framework and the research gap we aim to fill with this article. After that, we will describe our data and analysis. Then we will move on to our analysis, which provides an ethnographic account of the daily routines of the supermarket, focusing especially on how products are moved between the categories of food, excess, wastage, and waste in these practices. The analysis also describes the ways in which food waste is managed and brings out how different modes of valuation occasionally compete with each other in the practices. Finally, we will present some concluding thoughts.

2. Theoretical framework

2.1. The circular economy and situated practices

In this article, we look at how the transformation towards the CE is both helped forward and contested in routine everyday practices in the retail sector. We aim to contribute to the literature which focuses on the everyday making of circularity as well as to the scholarship on the 'socio-political implications and possibilities for shifting current production-consumption-use-waste practices' (Hobson 2016, p. 89). A growing body of research on different stages of the consumption-production system has problematised the straightforwardness of the practices of preventing waste, circulating objects (here, circulation refers especially to the different trajectories of the objects; whether they end up, for example, as sold, donated, or discarded), and turning waste into a resource through recycling practices and industrial solutions. For example, in her research on ordinary practices of circulating and sharing, Helen Holmes (2018) has pointed out how certain material properties of objects, such as different qualities of food, can unsettle practices of circularity. It has also been argued that it is unclear how potentially conflicting CE demands affect the everyday life of consumers (Hobson et al. 2021), and with regard to consumption practices and the CE's goal to 'design waste out of the system', researchers have noted that everyday consumption at homes is much more complex than 'securing the "right" flow of goods and disposing of the waste in the "right" way' (Mylan et al. 2016, pp. 10). Scholars have also criticised the CE's idea of waste as a resource by focusing on mundane maintenance and repair practices in biogas plants, stressing that transforming food waste into energy and fertiliser is not a closed loop but rather a messy process full of leakages and side streams (Holmberg and Ideland 2021).

In this article, instead of only focusing on the linear transition of food into waste or value, we aim to make visible the sometimes messy 'grey space' (Holmes 2018) between the categories of food and waste (for similar discussions concerning household food waste, see Evans 2012 and for household objects, see Hetherington 2004). We argue that understanding the everyday circularity in the retail sector would, among other things, require sensitivity and attentiveness to different categorisations of the products, the relations between these categories, and the constant work done by the employees to frame the items in certain categories. By this we mean that besides the fact that the products have to be actively kept in or removed from the category of food through, for example, ongoing maintenance of the shelves and discarding spoiling products, the products are also actively framed in the other categories, such as wastage or excess. Making these categorisations visible is useful especially to get a sense of how the products are valued in different stages, and how this valuation contributes to the making or disrupting of circularity.

While there exist ethnographic studies of household food waste and how people make sense of how food ends up as waste (e.g. Evans 2011), an insider's view on the everyday practices related to food waste in the retail sector has so far been largely lacking. In this article, we wish to fill that gap in research. We focus on the practices between the stages of ordering products to the supermarket and selling them out or ridding them. Drawing from Annemarie Mol's (2002) conception of ethnography as *praxiography*, we adhere to the idea that food, waste, and value are enacted in varying situated practices.[2] For example, a leek with shrivelled leaves is waste, but the same leek may also be a valuable product if the shrivelled leaves are removed by the supermarket employees. Thus, the value of the products is not simply attached to them in some cognitive evaluation, but their value is enacted in hands-on practices.

2.2. Frames, ridding and valuation

In the paper, we commence from the nowadays fairly commonly shared idea in the social scientific waste scholarship (see Moore 2012) that nothing is waste inherently and by its essence, but waste is enacted, brought into existence in situated practices, processes, and relations. We are particularly interested in the practices and processes through which things were established as being either waste or not-waste in the context of the supermarket where the fieldwork took place. This perspective shifts focus from starting from a fixed concept of waste to how food items move in and out of the category of waste. In *Frame Analysis* (1974), Erving Goffman (1974) suggests that actors perceive and organise reality with the help of various cognitive frames. A situation or an object may appear very differently depending on the frames used. A football

[1] For exceptions, see e.g. Mylan et al. 2016.

[2] According to Andreas Reckwitz, a "practice' (Praktik) is a routinized type of behaviour which consists of several elements, interconnected to one other: forms of bodily activities, forms of mental activities, 'things' and their use, a background knowledge in the form of understanding, know-how, states of emotion and motivational knowledge.' (Reckwitz 2002, p. 249). In this article, we draw from this much-cited definition.

game, for example, may be perceived quite differently by the fans of the rivalling clubs. Depending on which of the clubs they support, the fans may for instance experience referee calls as either just or unjust and have opposite views of whether a goal was offside or onside. According to Goffman, frames are mainly composed of culture, certain social features, belief systems, and history. Furthermore, an actor may be subject to several cognitive frames that guide their experience and actions (p. 27). The frames are also subject to change, as they are created in and through the continuous interaction of actors and the frame.

When examining different framings of products in the supermarket, we are interested not only in how the members of the staff apprehend them, but we also wish to inquire into how those frames, together with socio-material practices, enact different categories and realities to the products, depending on the situation. We draw from Michel Callon (1998) the idea that frames are formed physically by using different material means. For example, framing a product as waste is constituted spatially by taking it away from the store shelves and finally moving it into the waste container located in the loading bay. In other words, rather than focusing only on the various perspectives that the informants may have on food/waste, we aspire to attend to how the different realities or ontologies of the objects come to be. This approach comes with the overtones of situatedness and performativity: we examine the realities of the items as co-extensive with the frames and practices that construct or enact them (on situated ontology, see e.g. Mol 2002; Woolgar & Lezaun 2013; on enacting different ontologies of food waste, see Mattila et al. 2019). Thus, we insist that to grasp how the products move between different frames necessitates attentiveness not only to language, meanings, and culture, but also to the activity and dynamism of matter and our entanglement with it. The changing material characteristics of the products are taken into account by employees for example when performing calculations about whether a certain item should be removed from the shelves because of having gone bad or whether it can still be sold.

To take a closer look at the practices of framing the products, we focus on especially on the process of ridding. In her article on the valuation of used clothing and books, Emma Greeson (2020, pp. 169) points out that 'to understand how value is created, we must understand how goods are iteratively produced and reproduced through pragmatic, concrete processes of processing, sorting, categorizing, and/or (most crucially) ridding via various channels'. We argue that ridding is a central process for the main purpose of the store, that is, creating value by selling food products. In our analysis, we approach ridding as a gradual process (Lucas 2002; Evans 2012); before turning into waste or being donated, for example, the products that cannot be kept on the shelves go through a process of removal and alienation, which entails different placings and procedures (e.g. recording products removed from the shelves and storing products to be donated in a cold storage). To analyse the process of ridding and alienation, we focus on how the products are framed as food, excess, wastage, and waste. All of these categories were not explicitly verbalised as such in the field (the employees mainly used the concept of 'food waste' about all products that were not sold from the shelves), and thus they can be considered as interpretative concepts created by the researchers as a result of the analysis. They nevertheless also affected how the practices were socially and materially organised. By *food* we mean, simply, products that are sold from the shelves and not circulated through any other route. *Excess* refers to products that are somehow superfluous – usually, this means the potential surplus products that are ordered to keep the shelves constantly stacked. Moreover, excess is a liminal category through which products can move either back to the category of food, or to the categories of wastage or waste. By *wastage* we mean products that are removed from the shelves and thus there is a need to get rid of themone way or another - for example, they may be donated or sold through alternative routes. Finally, *waste* refers to products that are simply thrown away.

In our analysis, we suggest that the process of ridding the products is intertwined with valuation. Along the process, an object can change status from a saleable commodity to, say, wastage to be donated to charity depending on how it is valued; each framing of the items is connected to and guided by a particular mode of valuation. Drawing on the pragmatist idea of value as valuation (Dewey 1939; Helgesson and Muniesa 2013; Muniesa 2012), we do not approach value as an objective quality residing inherently in the objects that are sold or as a product of subjective judgment (e.g. pricing), but as an outcome of practices and actions (Muniesa, 2012; Lehtonen and Pyyhtinen, 2020) carried out by, for example, the supermarket employees, customers, and marketing devices. The evaluation, sorting, and management of the products potentially going to waste is intertwined with 'valorisation', that is, with the creation of value (Vatin 2013). The different situated modes of valuation (Çalışkan and Callon 2009; 2010; see also Geysmans et al. 2017) may occasionally also compete and clash with each other in the everyday operations of the store, for example when one mode of valuation stresses the monetary value of the items and another their non-monetary value. Above all, by paying attention to the different modes of valuation, we aim to make visible how the products are valued in different stages of the process of ridding, and how these modes play a part in the practices of keeping products in a certain category or moving them from one category to another.

3. Materials and method

3.1. The fieldwork and research method

The research materials of this article consist of 120 h of participant observation conducted by the first author. The fieldwork included ethnographic interviews with the supermarket staff, especially section managers. The store observed during the fieldwork is a big supermarket with an extensive selection located in the centre of one of the largest cities in Finland. The supermarket is part of one of the two store chains dominating the Finnish retail sector. Certain store specific features affect the amount and type of food waste generated, such as the shop's large size, the wide selection of products available, and the existence of a meat and fish counter as well as a salad buffet. Access to the field was gained by contacting the shopkeeper by using the online contact form of the store. After this, the first author planned and discussed the conduction and other practicalities of the fieldwork with the shopkeeper, and together they agreed that the work will be carried out by participating in the daily tasks of the store. The shopkeeper informed the supermarket staff about the research before the fieldwork took place, and the purpose of the research was explained to the employees who participated in the research and they signed a research agreement.

The first author worked at the supermarket with the section managers for one month. Not all foodstuff sections were included in this research. The reason for excluding some sections, such as that for canned food, from the research was the low quantity of food waste produced in these sections. The following table presents the observed sections, the main product categories in each observed section, and the time spent in each section. The sections in the table are divided based on how the responsibilities were divided between the section managers (e.g. the same section manager was responsible for both milk and bread sections) (Table 1):

As she took part in the daily work of the supermarket, the first author became very familiar with the tasks (excluding more demanding tasks, such as placing orders) the employees perform every day, such as shelving the products, checking the date labels, removing expired products from the shelves, placing new products on the shelves, and ordering the shelves. Since these tasks remained quite similar from day to day, the ethnographer was able to perform them independently and routinely.

Hands-on participation in the daily tasks affected the ethnographer's position in the field; the employees, managers, and customers of the supermarket mainly saw the ethnographer as one employee among

Table 1
The observed sections and the time spent in each section.

	Milk & bread sections	Convenience food and cheese sections & 'To go'shelf	Fruit and vegetable section	Fish counter	Meat counter	Salad buffet and fresh bakery product shelf
Product categories in the sections	Milk section: milk products (e. g. yogurt, milk) and juices, spreads and eggs. Bread section: breads and related products (e. g. bread and sweet baked products)	Convenience food, cold cut, sausages, cheese, vegetarian products and 'To go' shelf (located near to the entrance of the store, offering for example convenience food for 'a quick lunch')	Fruit and vegetables	e. g. Fish, clam	Different meat products (e. g. steak, marinated meat)	A salad buffet where customers can collect a lunch salad from the buffet, a shelf offering bakery products (e. g. croissants and Danish pastry) baked in the store
Time spent in the section	1,5 weeks	1 week	1 week and 1 day	1 day (the day included observing the salad buffet, bakery product section, fish counter and meat counter)	1 day (the day included observing the salad buffet, bakery product section, fish counter and meat counter)	1 day (the day included observing the salad buffet, bakery product section, fish counter and meat counter)

many. On the one hand, this was fruitful for gaining the trust of the people in the field but, on the other hand, it hindered the ethnographer's ability to document in detail the events and discussions immediately there on the spot. Thus, short jottings were written during breaks and more extensive field diary entries were crafted after each day. Due to the nature of the data, all the details presented in the analysis, such as the numbers regarding the percentage of food waste, should not be taken as exact facts. The reason for this is that the information was collected mostly during informal conversations with the staff, not from accurate documents and thus they are approximate estimations that might vary between different seasons. Presenting accurate food waste numbers here could also risk the anonymity of the store. However, the estimates presented in the manuscript are not of course just any random approximations since the section managers are always well informed about the sales.

The analysis of the data proceeded from a systematic reading to the coding of the data. The coding was conducted by identifying different practices of preventing and producing food waste as well as ways of framing the products by using different highlight colours in a word processor. After identifying the key practices and understandings related to food waste in the field, we decided to focus on the different framings concerning food products. In this, our methodological approach draws from Goffman's (1974) classical work on frame analysis that was introduced above, with the addition, however, that we pay attention not only to the meanings that food/waste is given, but also to the hands-on socio-material practices of dealing with food items and how they enact certain categories to the products (Callon 1998).

While the fieldwork was place-based insofar as it was conducted at the supermarket mentioned, it nevertheless amounts to a kind of 'relational ethnography' (Desmond 2014); we are interested not so much in the place itself or in the supermarket staff as a group as in the processes of generating value and waste – processes which involve configurations or assemblages of relations between various actors or entities (e.g. store management, employees, shelves, food products, decay, business calculations, and waste bins).

3.2. The Case: Finnish Supermarket, the CE and food waste

Finland was the first country in the world to prepare a national road map to a CE in 2016, which includes, among other things, goals to improve the management of the material streams of retail businesses by developing digital applications (Sitra 2016). Thus, CE is a useful analytic lens for studying food waste reduction and production practices in the retail sector. Although the CE was not generally used as an explicit concept in the store by the employees or the shopkeeper, food waste reduction and management was nevertheless a central normative ideal and practice in almost all of the everyday operations in the store.

Finnish retailers have set numerical objectives to reducing food waste and report produced food waste in their annual sustainability reports (Mesiranta et al. 2021). They have also made efforts to avoid discarding the unsold food, such as donating wastage food to food banks[3] and optimising orders by developing information systems that predict the sales, and these actions have led to food waste reduction in the retail sector (FGT n. d.b). If waste cannot be prevented, then it should be used as a resource for, for example, biogas production.[4] At the same time, Finland can be considered as an example of an abundant society; a large variety of items is available in Finnish retail stores, and this is also one of the root causes of retail food waste (Gruber et al. 2016). Moreover, the Finnish retail sector is strongly clustered with two dominating retail chains. Thus, the retail sector has much power over the producers, and this is manifest for example in quality standards concerning the products, which may lead to food waste also in other parts of the food chain (see also Devin and Richards 2018). These issues make the Finnish context is of particular interest for the research concerning food waste and the CE especially from the viewpoint of problematising the straightforwardness of the CE discourse (see also Holmberg and Ideland 2021) – regardless of the rather efficient managerial practices of preventing waste, on the level of everyday practices, waste prevention is still always situatedly negotiated with unavoidable leakage and wastage.

4. Analysis

4.1. Food

Framing products in the category of food is embedded in the everyday, routinised practices in all of the observed sections of the supermarket. The day begins with each section manager removing expiring products from the shelves before the store opens. The act of separating the unwanted and spoiled products from the still sellable ones is crucial for establishing certain items as food. This observation is in line with Greeson's (2020) argument that the concrete processes of sorting, categorising, and ridding are crucial for value creation: the products on the shelves cannot be made desirable without first ridding the unwanted products.

In some sections, such as in the convenience food section, products that will expire within the following three days are usually marked with a '-30%' discount sticker. If there are several similar soon-expiring

[3] In Finland, food banks are organisations operating mainly in the voluntary sector. They collect surplus food from supermarkets and hand it out to people with low income.

[4] In Finland, 100 % of the biowaste from the retail sector is recycled and none of it ends up in landfills (FGT, n. d.b). However, as the data used in this article does not enable us to analyse this further, in our upcoming work we will examine the waste treatment practices in more detail.

products from the same brand, sometimes the section manager may also set a discount campaign on those products. Selling expiring products at a discount is a mode of valuation that aims to prevent the soon-expiring products from ending up as *wastage* or *waste* and retain them in the category of food. By contrast, in some sections, such as in the milk section, the '-30%' discount stickers are not used at all, and the soon-to-expire products are donated to the food bank. However, in other sections, too, there were situations where the discount stickers were not used. The following observation is from the convenience food section:

> Yesterday I checked the dates of the products on the 'To go' shelf. On it, all products that spoil on the same day are usually provided with a discount sticker. I had labelled the products of a certain brand that would go bad that very same day, but today the person in charge noted that the products of this particular brand should not be labelled, because the items that are not sold are reimbursed by the producer. *Field diary entry, 13 Sept 2019*

As the fieldnote suggests, removing products from the category of food does not always equal financial loss for the supermarket. The store has established contracts with some producers that entitle it to a refund from certain products if they are left unsold. This exemplifies the power that the strongly clustered retail sector has over the producers in Finland: to be able to get their products on the shelves, in these cases it is the producers who are forced to bear the financial risk related to wastage.[5] It is crucial to note, however, that the particular situation described above concerned one specific product from one specific brand; the other products in the same section were provided with a discount sticker and thus they were kept in the category of food. The practice nevertheless reveals that here the mode of valuation primarily prioritises the possibility to get a refund from the product and thus save money rather than retaining it in the category of food. It is up to the section managers whether they use the discount stickers in their sections; the section managers' own situated understandings, valuations, calculations, and knowledge significantly affect whether they consider the use of the discount stickers as reasonable or not.

Alongside checking the date labels and placing the discounts, the section managers have a daily routine of organising the sections, and these organising practices crucially contribute to the framing of the products as food. The following field diary entry describes the logic according to which the shelves are organised:

> When we were checking the date labels the section manager advised me to arrange and sort the breads so that the oldest products are at the front and on the top, while the newest are at the back. According to the section manager, the front of the shelf is the best-selling place and, to avoid loss, soon-to-expire products must be sold as soon as possible. At the same time, the section manager pointed out that it is important that the shelves are organised to look ordered, clean, and full before the customers come in when the store opens. *Field diary entry, 3 Sept 2019*

To keep the products framed as food, the sections have to be constantly organised to prevent the products from spoiling before they are sold. Moreover, to make the shelves appear inviting for the customers, it is also important to keep them full. After organising the shelves, the section managers and other employees start shelving the daily shipment of items. The pictures below illustrate the difference that organising and stacking the shelves makes (Fig. 1).

In the fruit and vegetable section, the everyday routine is a bit different compared to the milk, convenience food and bread sections. In it, only expiring products with date labels are removed before the store opens. The products that do not have date labels have to be evaluated by using one's senses as judgment devices, based on the smell, texture, and appearance of the items (see also Lehtonen and Pyyhtinen, 2020). This is done during the work day while shelving the daily shipment of products. The section manager of the fruit and vegetable section said that she usually 'repairs' some products (for example leek and kale) and thus preserves them in the category of food whenever this is still possible by removing shrivelled leaves from them. She said that 'she cannot accept them to end up as waste', since the items can often be salvaged and kept on the shelves with a little effort. Thus, the different material properties of the products affect the possibilities of circulating them (see also Holmes 2018). The required ongoing valorisation described in this section shows how the products are in a constant state of potential change from food to excess, wastage, or waste, and how the store employees aim to constantly reframe and renegotiate their ontological status through using their skills and resources to make soon-to-expire products still desirable and sellable (in cases when this is still considered reasonable). Yet, at the same time, the store is able to operate efficiently only provided that the shelves are kept full and inviting, and this is bound to produce excess. The framing of the products as food is therefore to some extent dependent on excess. We will analyse this in more detail in the next section.

4.2. Excess

During the fieldwork, it turned out that it is a common principle for the operations of the supermarket to order slightly too many products to the shop to keep the shelves constantly stacked. For example, the section manager of the milk and bread sections brought out that food waste is part of the normal operations of the store, and a steady amount of food waste proves that the section is well managed. We call these products *excess* here. By excess, we refer to the fact of 'having too much of something', in contrast to scarcity (which is to 'to have too little of something') and abundance (which equals 'having an unproblematically sufficient amount of something') (Abbott 2014). It is crucial to note that the store employees themselves mainly used the word 'food waste' for all products that were removed from the shelves, and thus the usage of the terms here is partly overlapping. The food products are framed as excess when they are removed from the shelves (but not yet discarded) or are considered as superfluous otherwise. They might, however, still change their status back to food, or alternatively they may turn to wastage or waste (see also Evans 2012). Thus, in the context of the supermarket, excess is in a sense a liminal category that creates a 'gap' between disposal (see also Hetherington 2004) and possible alternative circulations. The amount of excess varied between different sections, and in some sections its percentage was really low.

During the last twenty-five years, the selection of food products in grocery stores has tripled in Finland (FGT n.d.a). On the one hand, a large selection of items along with alluring novelties increases the competitiveness of the store. On the other hand, consumers are used to a wide selection of items and expect to find everything they want from the shelves. For example, in the beginning of the coronavirus pandemic, when people hoarded some products, the temporary lack of certain items raised serious concern in some consumers about food security. Thus, excess is a crucial category when the supermarket aims to maintain their competitiveness and keep the customers happy. However, while the production of excess and thus potential waste is something known and even planned in advance, this does not mean that the employees, managers, or the shopkeeper would be indifferent to the amounts of food waste generated. In fact, they work hard to minimise the amount of waste produced, and usually their goal is to generate less food waste than what is set as the goal percentage of each section.

One of the key devices in the management of the flow of food in and out of the supermarket is a digital device that is used by the staff to track the food waste produced. At the same time, this device is central for the practices of framing excess, as it creates concrete divisions between food

[5] This practice in the Finnish retail sector is, however, potentially going to be banned in the near future due to the upcoming legislative actions in the EU and Finland (Government proposal HE 199/2020 vp, 29.10.2020).

Fig. 1. Bread shelf before and after ordering and stacking.

and excess and is thus helpful in the alienation and removal of products (see also Lucas 2002). The device is connected to the data concerning the products available in the supermarket's selection. The following field note describes the usage of this device:

> Using the device, the section manager recorded in the information system of the store all the breads that were removed from the shelves. The section manager always carries this device with her. The device looks a bit like a large vintage mobile phone. It is used, for example, for recording food waste and marking the prices of the products to the small digital screens that are attached to the shelves. The barcode of a product removed from the shelf can be read by using the device. Then the correct function has to be chosen from the device, in this case the function is 'food waste'. This procedure ensures that the store is always keeping track of what happens to the products. *Field diary entry, 3 Sept 2019*

It is crucial for the operations of the store to stay in control of the production of excess, and thus all waste has to be constantly tracked. All section managers and employees use this device for example for pricing the products and recording food waste or products that are reimbursed. It allows them to follow the sales accurately and keep records of every product that is removed from the shelves. When performing these recordings, the employees reframe the products from the category of food to excess. Thanks to this practice of tracking and keeping records the store can maintain the loss caused by each product at a reasonable level and remove from the selection products that have too little demand. Usually, the section managers are responsible for estimating whether products cause too much loss.

Since the production of excess has to be monitored and controlled, every section has its own individual goal percentage for food waste, and these are central for the efficient operation of the store. Through these goal percentages, the framing of excess starts in a sense already before the products actually enter the store, and thus the category of excess is spatially undetermined. In the sections observed, these percentages varied considerably: the smallest goal percentage was 0.5–1.5% (the milk section) and the highest 12–13% (the fish counter). The section manager of the fish counter said that the shopkeeper considers the high food waste percentage as acceptable, since the fish counter also brings big profits for the supermarket. The following fieldnote describes the discussion that the ethnographer had with the section manager:

> The manager of the fish counter said that this store has an extensive selection of fish, much wider than many other stores have. Thus, the fish counter is one of the main attractions of the store. It offers specialties, such as fresh tuna and oysters. The food waste percentage of the fish counter is rather high, even twelve to thirteen percent. This results from the wide selection. The manager said that this is part of the selling strategy of the store, and the high percentage of food waste has been calculated as being profitable. *Field diary entry, 30 Sept 2019.*

The goal percentage for food waste at the fish counter is calculated based on cost-effectiveness: the economic loss caused by the production and treatment of waste needs to be smaller than the profits gained by maintaining a wide selection. Thus, the mode of valuation here allows controlled leakage. However, according to the section manager, the employees also make a great effort to valorise the excess from the fish and meat counter, and thus there is also another mode of valuation at play that aims to categorise products back to the category of food and thus avoid leakage. Some of the surplus fish and meat from the counter can, for example, be used in ready-made meals that are sold in the meat and fish counter and cooked in the store. Moreover, fresh fish can be smoked and sold in the fish counter after the point when it is no longer good enough to be sold as fresh. Here, the utilised products are reframed from the category of food to the category of excess and again back to the category of food. However, this valorisation requires careful planning and concrete hands-on work from the supermarket employees. They take time, and according to the employees, there is not always time to do this. In other words, it is not always considered worthwhile to engage in this valorising process. Thus, perfectly edible excess food that could still be circulated ends up as waste. The valorisation has to emphasise the reasonable use of working time, and this requires that one sometimes accepts possible leakages in the circulation of the products. Next, we will analyse how the products circulate in cases when they cannot be reverted to the category of food but are framed as what we call 'wastage'.

4.3. Wastage

When the products cannot be reverted to the category of food from the liminal category of excess, they enter the category of wastage. By wastage, we mean products that are not sold by the supermarket from the shelves, but are ridded through alternative routes, for example by donating them to food banks or by selling them as leftovers in collaboration with business partners. While excess is a spatially undetermined category, and excess products can be reverted to the category of food, wastage food is separated from the products sold in the store by being moved to the 'back room'. Here, the 'back room' not only creates a certain conduit for ridding the wastage food (Evans 2012; see also Gregson et al. 2007) but also enacts a clear categorical separation

between wastage, on the one hand, and food and excess, on the other.

The ways of valorising wastage were different depending on the section and the varying qualities of different products. For example, in the convenience food section, the products that will expire sooner than within the following three days (or have already expired) are usually either discarded (expired products) and thus are framed as waste, or donated to the food bank (products that have not yet expired but are removed from the shelf) and enacted as wastage. In the milk section, the date labels are checked on alternate days, and soon-to-expire products are either discarded (products that are not edible/drinkable) or donated to the food bank. In the bread section, the date labels are checked every day, and the products that will expire on the same day are usually sold by using a particular Food Waste Application[6] (usually bread and buns) or discarded (typically sweet baked products that have to be stored in cold temperature). Bread and bun bags to be sold through the app can be stored in the tables located in the store's large warm storage space until they are picked up by the customers. On the contrary, products that require cold storage are not usually (with few exceptions) sold through the Food Waste Application, since keeping them stored until they are picked up is not always considered reasonable due to limited cold storage space.

The store gets money and visibility from selling the wastage food through the Food Waste Application, while donating them to the food bank does not financially benefit the store (while of course it is beneficial to the store to be able to publicly announce that they donate their wastage food to food banks rather than discard them). Even if the store does not gain money from the donations, some employees saw donating the wastage food to the food bank as valuable in other terms:

> The section manager of the convenience food section told me that she thinks it is nice that the food bank gets the products going to wastage from her section. She was especially impressed by how the organisation is largely run by volunteers. She said that it feels good that people in need get the edible wastage food and that especially during Christmas time it is nice that people with low income get something on the Christmas table. *Field diary entry, 9 Sept 2019*

All modes of valuation in the store are not driven just by the principle of economic efficiency: as the field note suggests, donating the wastage food to the food bank is based on the ideas of morality and gifting (see also Holmes 2018). However, at the same time, food banks have been criticised for depoliticizing the injustices of the food system (Williams et al. 2016), and the fact that poor people have to rely on 'the leftovers of the rich' can be stigmatising and humiliating for them (Fig. 2).

When products are sold on the Food Waste Application, the mode of valuation is quite different compared to donating: in the case of the Food Waste Application, the fact that the products are framed as wastage forms a significant part of their desirability, and explicitly marketed as such, thus turning the potentially stigmatising aspect into something positive: while saving money, the customer does good to the environment by buying the wastage food and not letting them go to waste. In addition, the store gets positive visibility through collaborating with the app: the contract highlights the store's efforts in minimising food waste, and the customers might also purchase something else when they come to pick up the wastage bags. Thus, here the mode of valuation is based on the idea that circulating the products can create economic benefit, and the customers can choose to be 'responsible consumers' who contribute to food waste reduction.

Selling the products through the app is not, however, always simple: the time and the resources the employees have for handling the wastage food affects whether the products end up as waste or not, and different qualities of the products themselves condition the possibilities for

Fig. 2. Products from the convenience food section waiting in the cold storage to be picked up by the volunteers of the food bank.

circulating them. For example, sometimes the still edible fruit and vegetables that are removed from the shelf are sold on the Food Waste Application and thus remain in the category wastage rather than turn to waste. However, according to the section manager, there is not always enough time to prepare them for the sale, since it takes a lot of time to evaluate the items one by one, whether a particular fruit or vegetable is still good enough to be sold for a reduced price or needs to be discarded:

> Today, there were several boxes of waste from the fruit and vegetable section. They were collected in one trolley. I then took the trolley to the backroom, where I separated the spoiled items from the still usable ones, which I placed in the Food Waste Application bags. Some of it, however, ended up in the bin, as they could not even be used for the bags. If there has been a considerable amount of excess from a certain product, I have moved it to the cold room to wait for the next day, so that I can use the items for the Food Waste Application bags; one cannot stuff the bags with one kind of product only, but one should use a variety of products. It however takes a lot of time to prepare the bags (approx. 30–45 mins for myself), so one always simply does not have the time to make them. *Field diary entry, 20 Sept 2019*.

To be able to sell the wastage food through the Food Waste Application, they need to be made edible and valuable through concrete work. This means, for example, removing mouldy grapes from grape boxes or separating spoiled vegetables from the still edible ones. This concrete work of saving food from the waste stream often remains invisible (Abrahamsson 2019), but it has consequences for how food is moved from one category to another – in other words, whether it ends up as waste or not. Moreover, valorising the surplus products requires that they can be stored in the cold, sometimes for several days; the bags sold through the Food Waste Application must contain items from more than one product and they have to be full. Thus, if you have several boxes of surplus cucumbers, you can only sell a part of them in one day. It for example happened once during the fieldwork that almost a whole shipment of cucumbers was not sellable, since they were probably stored in too cold a temperature during shipment and thus, they had turned soft. The ethnographer stored these cucumbers in the cold and waited to get a larger variety of products at hand later for the cucumbers to be sold. As we argued above, while keeping the products framed as food requires ongoing work for the store employees, it also takes a lot of hands-on work to keeping them framed as wastage that can be circulated through alternative routes (Fig. 3).

The staff also has to pay attention to the quality of the bags. Related to customer satisfaction, the section manager of the fruit and vegetable

[6] The Food Waste Application, anonymised here, is a mobile application that allows grocery stores and restaurants to sell their still edible leftover products that would otherwise be discarded.

Fig. 3. Ethnographers' storage of wastage food.

section was sometimes worried about whether the consumers even realise that they buy wastage food that is not at its best anymore when they use the application. Thus, resulting from the extensive work and consideration that selling the wastage food requires, sometimes a more appealing or the only possible alternative for ridding them might be discarding them and thus frame them as waste. In the next and final section of our analysis, we will scrutinise how this framing happens.

4.4. Waste

If the products cannot be salvaged from the waste stream during the process of ridding, they are discarded and thus framed as waste. During the fieldwork, it became apparent that the generation of waste is considered more or less as a normal part of the everyday operations of the store by the employees. Nevertheless, occasionally they also felt bad for having to discard food:

> When we were in the break room, the merchant trainee asked me whether I have been satisfied with my observation period and added jokingly whether I will write about how I have committed in food waste reduction practices by eating chocolate and bread in the break room (some excess bread from the bakery product section as well as some expired chocolate and candy are usually taken to the break room so that the employees can eat them during the breaks). Becoming more serious, the merchant trainee brought out that he is sometimes shocked by the amount of waste when he takes it to the waste container located at the loading bay *Field diary entry, 19 Sept 2019*

As the field note suggests, here the mode of valuation does not emphasise only issues related to economic efficiency of the store operations when discarding food. It was against the merchant trainees' own principles to discard food, since he felt concerned about the amount of food waste generated. Thus, the employees do not always straightforwardly and without moral reflection consider food waste as a normalised and taken for granted part of the store operations, but on some occasions the issue was clearly more controversial. What is more, the field note highlights how the process of framing products as waste happens, again, through socio-material and spatial relations: when the unsellable products are taken to the loading bay of the store and placed within waste containers, the biochemical properties of the items may not change the least bit, and yet their ontological status seems to be irreversibly altered from food to waste (see also Lehtonen and Pyyhtinen, 2020). The waste container consolidates and reinforces, as it were, the categorisation of the object as waste.

The loading bay is a central nodal point for the flow of products in and out: products come in through it, but on the other hand, food waste (and other kinds of waste too, such as plastic and cardboard) as well as reusable storage boxes are also circulated through it out from the store. Framing products as waste through moving them to the loading bay and, eventually, to the waste container, separates them from wastage located in the back room of the store (as well as from the food products located on the store shelves). A process of sorting and categorising, as described in the previous sections, precedes this practice of removal of unwanted products (Fig. 4).

During the fieldwork, the ethnographer noticed how the main goal in preventing waste in the supermarket is not always related to exhausting the value of the object before discarding it, but first and foremost to ensure that no money is wasted when it is possible to avoid wasting it. Accordingly, when talking about waste prevention, the employees did not always refer to efforts to prevent the generation of food waste; occasionally, for them, 'wasting' also meant loss of economic resources. For example, the section manager of the milk and bread sections voiced that 'I have been taught that an empty shelf equals waste for the supermarket'. When the ethnographer asked the section manager what she exactly meant by this, she said that if the shelf is empty when a customer arrives to buy a certain product, the customer most probably goes to another store to buy the product they were looking for. In her description, 'waste' thus embodies the idea of wasted potential or opportunity; money is wasted if the shelves are not kept stacked. These two different wastes, loss of food and loss of money, do not always coincide. Rather, not surprisingly, sometimes preventing the store from losing money was valued as more important than the generation of food waste; as long as the store would avoid losing customers and money, food waste was often often regarded acceptable, provided that its production was kept under control and within certain limits:

> The section manager apparently unshelved almost an entire batch of certain products and said that if this happens even once again, they have to remove the product from the selection entirely. I mentioned that I feel like the particular product always causes a great deal of waste. The section manager responded that it is alright to have some waste, but there should not be this much of it. *Field diary entry, 26 Sept 2019*

Here, the mode of valuation employed strongly emphasises the economic efficiency of the store operations. In our view, this was an essential way for the supermarket staff to make sense of discarding food, even if at least some of them felt bad or morally controversial for doing so.

While the amount of food waste produced at the supermarket was to a great extent a result of efforts to secure product availability, there were

Fig. 4. Discarded sweet baked products.

other reasons, too, why food items went to waste. In some cases, food waste was generated simply due to the unpredictability and business of everyday life in the store. Occasionally, the difficulties in communication, lack of knowledge (this concerns especially employee replacements during weekends and holidays), and lack of time led to food waste. For example, sometimes when the ethnographer was shelving the products, the shelves of some sections were so full that there was not always time to organise them so that the oldest products would be placed in front. Because of this, some products were buried to the back of the shelf, and these products easily expire or even spoil. Further, the daily work in the supermarket is often hectic, and this causes disruptions in the communication between the employees: every day there are enormous masses of products arriving at the store that have to be placed, organised, and sometimes also priced. If more than one employee is responsible for shelving the products in a section, it is almost impossible to communicate to the section manager about all the issues related to the discounts and placing or pricing the products. Thus, the management of the sections is not always perfectly efficient and products may also end up as waste as a result of this.

5. Conclusion

In this article, we have analysed through ethnographic fieldwork the situated practices of producing and reducing food waste in the Finnish retail sector, paying particular attention to how the products were framed and valued in these practices. Instead of assuming a simple linear food-to-waste transformation, our analysis has focused on the 'grey space' (Holmes 2018) between these two categories in the store, with a special focus on ridding as a gradual process. This has been done to better appreciate the complexity of the careers of things in the process of ridding. With its praxiographic approach, the article has provided an insider's view on the everyday practices and framings related to food waste in the retail store that served as the site of the fieldwork. Our analysis is in line with social scientific waste studies that have often pointed out that waste reduction and moving products between different categories requires concrete labour and hands-on work (Gregson et al., 2013; Lehtonen and Pyyhtinen, 2020; O'Brien, 1999; Reno, 2009). It is important to note that while the hands-on work was crucial for creating circular practices in the store, the practices themselves also entailed and led to leakages that disrupted circularity.

The leakages often occurred in the event of clashes between different modes of valuation, for example when saving money was valued above preventing waste. The employees did a lot of work to frame and retain the products in the category of *food* by for example constantly organising the shelves so that the products would not spoil before they are sold as well as providing discounts on expiring products. However, on some occasions, the products were framed as waste instead and discarded, if this was seen as more reasonable from the perspective of saving money. With regard to *excess*, which was the second category that we analysed, hands-on work was done in order to control and calculate the number of items that are framed into this category. Here, the mode of valuation allowed leakage provided that it was controlled and cost-efficient, but for example surplus fish and meat could still sometimes be salvaged from the waste stream and reverted to the category of food through utilising them in ready-made meals. This was not, however, always done in order to use the working time efficiently. When products were framed as *wastage*, which was the third category in our analysis, they were often salvaged by donating them to the food bank or by selling them as leftovers in collaboration with the Food Waste Application company. Especially when the products were donated, the mode of valuation emphasised the ethical aspect of the practice: donating was framed as a form of helping those in need. The practice of selling the products on the app, too, to some extent entailed a form of ethics besides the prospect of still getting some money out of them, but now the mode of valuation stressed ecological virtues instead of philanthropy and solidarity; the wastage food distributed by using the app was marketed to the consumers with the idea that they can choose to save the products going to wastage. In other words, the consumers were lured into buying into a certain kind of ethics – of doing good to the environment – when buying the products. As maintaining the food products in the category of wastage by preventing them from going to waste in some cases required a lot of work and sometimes also cold storage space, occasionally some of the products were just discarded. *Waste* was the fourth category that we analysed. Some employees expressed in a straightforward manner how bad they felt about having to discard food, and yet to a certain extent food disposal made sense economically, since loss of money was considered as a more severe harm than producing food waste. In other words, here the mode of valuation stressed the economic efficiency of the store operations over successful waste prevention. So, while the store employees and the shopkeeper all worked hard to minimise waste whenever they considered it as reasonable to do so, creating circular practices was clearly a challenge when having to at the same time try to maintain efficient store operations.

Our article contributes to the research on the everyday making of circularity by making visible the multiple categorisations that products may undergo during the process of ridding, thus shedding light to the complex processes through which the products end up as waste or something else; not all the food items that were unsellable from the supermarket shelves ended up in the bin as waste, but they were also categorised as excess and wastage, and they could be circulated or sold as wastage food through optional routes. Our analysis also showed how the different framings of products were not only an outcome of some cognitive judgements but involved concrete hands-on practices that enact different realities to the products. These practices participated in moving the products from one category to another, but also in retaining them in a certain category (e.g. when selling the products in the Food Waste Application, it was particularly important to maintain the framing of wastage by preventing the items from spoiling). What is more, the category of food appeared to be constituted in relation to the other categories that we identified: the production of excess, wastage, and waste was central for keeping the shelves stacked and inviting. Thus, according to our interpretation, while striving to meet circular economy objectives, the store operations nevertheless did not seek to avoid leakage completely, but rather keep it under control; a certain level of food waste was deemed acceptable. Moreover, the practices of circulating wastage described in the analysis were crucial for making sense and justifying this leakage. Therefore, we suggest that understanding the relations between different categories of objects, their socio-material constitution, and spatial arrangements is crucial for understanding how circular practices as well as their potential leakage are, and can be, created not only in retail stores but other environments, too.

CRediT authorship contribution statement

Taru Lehtokunnas: Writing – original draft, Writing – review & editing, Investigation, Conceptualization, Methodology, Funding acquisition. **Olli Pyyhtinen:** Writing – original draft, Writing – review & editing, Conceptualization, Methodology, Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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PUBLICATION II

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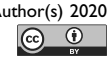

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Towards a circular economy in food consumption: Food waste reduction practices as ethical work

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Abstract

This article explores the transition towards a circular economy in the context of household food waste practices. The research concerning the circular economy has mainly focused on engineering or the processes of production, manufacturing, business and industry. However, the transition towards a circular economy requires, in addition to new technologies, infrastructures and innovations, a societal change and a change in everyday practices. In this article, we address this by examining the everyday practices of food waste reduction in households as ethical work. We claim that the intertwined practices, institutions and policies of the circular economy create moral categories and responsibilities in everyday food consumption. Thus, the transition towards circular economy requires everyday ethical work carried out by consumers. However, our analysis also brings out some possible challenges related to this transition that has not yet been accomplished. Our research materials consist of 26 food waste diaries collected from Finnish households and participant observation in 4 leftover cooking workshops organized with the Finnish Martha organization. We adapt Michel Foucault's conception of ethics, focusing on the constitution of ethical subjectivity in food waste practices. Moreover, we utilize practice theoretical approach that has been widely used in food waste and sustainable consumption studies and connect it with Foucault's theory. Our results suggest that in order to understand the circular economy as a moral economy, it is crucial to note the moral complexity of everyday life that results from partly contradictory ethical sensitivities and practices.

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Introduction

Production of food waste is currently significantly affecting the sustainability of the food system, alongside the consumption of meat and dairy products. Due to the economic, environmental, and social significance of food waste, reducing it is also part of the European Union's Circular Economy Strategy (Prieto-Sandoval et al., 2018). The aim of this strategy is to increase resource efficiency by maintaining the value of materials, through closing the loop of the product life cycle (EU Commission, 2014). Thus, the transition towards a circular economy (CE) requires changes in technological infrastructures, business models and consumption practices (Geissdoerfer et al., 2017). However, research concerning the CE has mainly focused on the engineering domain and the processes of manufacturing and production (Korhonen et al., 2018). More research is needed for understanding the transition in the socio-material underpinnings of everyday life that the transition towards a CE requires (Mylan et al., 2016).

This article argues that a CE is a moral economy (Gregson et al., 2015). This refers to an economic approach that aims to assess the moral justifications of the economic organization and, moreover, the responsibilities and possibilities of acting in its context (Sayer, 2015). In the context of the CE, moral categories that are created through the moral problematization of practices perceived as unsustainable or morally wrong are part of the logic of economic organization (Gregson et al., 2015). For example, such commonplace food consumption practice as reusing leftovers is a morally and ethically charged activity that constitutes consumer subjectivity. This article takes the practices of living with the abundance of food as its starting point.[1] Thus, our perspective is based on the necessity of dealing with excess production (Valkonen et al., 2019). As things stand, current production volumes force people to find environmentally and morally sustainable ways to live with food waste and other excess materials.

To explore this subject, we adopt Foucault's (1994) theory on ethical subjectivity to examine the practices of reducing food waste. Foucault's (2003) theory enables not only the examination of individual consumer practices but also the suggestion of wider modes of ethical action in society as well. In addition to Foucault's conception of ethical subjectivity, our theoretical framework draws from the practice-theoretical approach (Evans et al., 2017; Reckwitz, 2002; Shove, 2010). Practice theories have been previously used as an analytical framework in research concerning sustainable consumption in general (Gram-Hanssen, 2011; Plessz et al., 2014; Shove, 2003) and food waste in particular (Evans, 2011; Mattila et al., 2019; Närvänen et al., 2016; Southerton and Yates, 2015).

We address the practices of food waste reduction as everyday ethical work on the self that aims to transform food consumption practices towards sustainability. Our research is guided by the question, *how is ethical subjectivity constituted for reducing food waste in the context of circular economy?* Our research materials consist of participant observations from leftover cooking workshops organized with the Finnish Martha Organization and food waste diaries from Finnish households. The study participants are mainly people interested in sustainability and the reduction of food waste and thus construct their ethical subjectivity in this context. Although we adapt the Foucauldian approach to ethics, we also perceive that the ethical subjectivity in relation to food waste is constituted in situated and sometimes 'messy' mundane events (Woolgar and Neyland, 2013). Based on this, we perceive the ethical relation as constantly produced and situated in everyday practices, not simply internalized by our participants.

The circular economy, food waste and practice theory

The CE can be defined as an alternative to the so-called linear economic model of 'take, make, and dispose' perceived as unsustainable (Ness, 2008). The transition to a CE requires not only improved treatment of waste but also the curtailment of disposal (Ghisellini et al., 2016). Thus, the implementation of a CE calls for radically alternative solutions in the whole economic model and resource management (Ghisellini et al., 2016). Moreover, some researchers have also emphasized the importance of the connection between the generation of (food) waste and waste management (Alexander et al., 2013) – in CE, the use of waste for profit may conflict with the aim to protect the environment by reducing waste (Valkonen et al., 2017).

The fields of industrial ecology and both ecological and environmental economics have been the most significant domains to date for research concerning CE (Ghisellini et al., 2016; Korhonen et al., 2018). However, the research on CE has paid less attention to consumers and consumption. This would be crucial for better understanding the transformation to a CE, since the transition requires changes in everyday consumption practices (Mylan et al., 2016). As Hobson (2016) has argued, '[E]xtant academic, policy, and business-led analyses frame transformations towards the CE as predominantly issues of innovation, technical systems, fiscal and business incentives, and reformulated business models' (p. 89). To fill this gap in research, we analyse the transition towards a CE from the viewpoint of everyday food waste practices in households.

Our research takes place in Finland, where food waste became a widely discussed problem after the Finnish Institute for Agriculture and Forestry (MTT) began investigating it at the beginning of the 2010s (Raippalinna, 2019). Like in other countries in the Global North, most of Finland's food waste emerges in households – the amount of food wasted annually by households is 120–160 million kilograms (Natural Resources Institute Finland (Luke), n.d.). In addition,

Finland's public discourse is affected by EU objectives for consumer-level food waste reduction (Raippalinna, 2019).

We adopt the practice-theoretical approach in our analysis (Hargreaves, 2011; Warde, 2014). According to a much-cited definition by Reckwitz (2002), a social

> 'practice' (Praktik) is a routinized type of behaviour which consists of several elements, interconnected to one other: forms of bodily activities, forms of mental activities, 'things' and their use, a background knowledge in the form of understanding, know-how, states of emotion and motivational knowledge. (p. 249)

Practice theory is increasingly applied in the domain of sustainability research because it allows consumption to be analysed as a social phenomenon (Corsini et al., 2019). Some of the previous practice-theoretical research concerning food waste and sustainable consumption has stressed that sustainability policies cannot be targeted only to change the actions of individual consumers while the material and social contexts of (over)consumption remain unchangeable (Evans, 2011; Evans et al., 2017; Shove, 2003). Thus, research on sustainable consumption should shift focus from individual consumers to the collective, routinized, and mundane aspects of consumption (Gram-Hanssen, 2011). Moreover, Sahakian and Wilhite (2014) state that in the context of sustainable consumption, agency is distributed between people, objects and infrastructures that influence and are influenced by everyday life. Thus, unsustainable behaviour cannot be changed simply through top-down management or behaviour change; rather, the surrounding circumstances must be addressed as well.

Social scientific research concerning food waste and sustainable consumption has paid little attention to the transition towards the CE, apart from the research of Mylan et al. (2016) on domestic food provisioning. However, practice-theoretical food waste research has shown, among other things, that the social, material and temporal contexts of eating are important for understanding the production of food waste in households (Southerton and Yates, 2015), that preventing food waste through cooking from leftovers requires varied culinary skills and knowledge (Cappellini, 2009; Närvänen et al., 2016), and that the production of food waste is a consequence of keeping a family well-fed (Watson and Meah, 2012). It has also acknowledged the significance of nonhumans in the production and reduction of food waste (Mattila et al., 2019). Moreover, Alexander et al. (2013) have pointed out that the cause for household food waste can also sometimes be earlier in the food chain – for example, household food waste might emerge from too big portion sizes.

From these viewpoints, the material and social contexts of everyday life and the embodied knowledge are central to the production and reduction of food waste. In line with the above, we approach food waste reduction as a social practice, emphasizing the dynamics between ethical action and persistent socio-material practices that delimit transformation. We connect previous practice-theoretical work on food waste and sustainable consumption studies with Foucault's (1994) theory concerning ethical subjectivity. According to Reckwitz (2002), Foucault's late work on ethics can be perceived as 'praxeological'. However, Foucault's work

has not been widely used in practice-theoretical research on food waste or sustainable consumption, apart from Hawkins' (2006) research concerning the ethical relationship to waste. Thus, this article deepens the understanding of ethical subjectivity in practice-theoretical research on food waste.

Moral economies and the constitution of ethical subjectivity in food waste reduction practices

We approach the transition towards the CE in everyday practices through the concept of moral economy. Gregson et al. (2015) have pointed out, in their research concerning the CE and resource recovery in the EU, that a CE is a moral economy, since there are right and wrong ways to circulate materials. By referring to the discussion concerning moral economy, we aim to highlight that the practices, institutions and policies connected to the CE create moral categories in the mundane practices of everyday life. These categories could be expressed, for example, through obligations such as recycling food waste. Thus, the concept of moral economy is useful in understanding the transition to the CE at the level of everyday life.

Our analysis on the moralities of the CE is guided by Foucault's (1994) conception of ethics as arts of existence. Foucault (1994) states that the self is not given to us and that to become ethical subjects, we have to constitute ourselves as ethical beings. For Foucault (1994), the constitution of the ethical self is not self-centred action – it is about creating an *ethos*, a way relating to others. He divides the arts of existence into four techniques of the self: ethical substance, mode of subjectivation, self-forming activity and *telos* (Foucault, 1994: 263–266). Ethical substance refers to the part of the self that is worked over by ethics, in other words, the matter of the ethical work (Foucault, 1994: 263–264). The mode of subjectivation means 'the way in which people are invited or incited to recognize their moral obligations' (Foucault, 1994: 264). Self-forming activity refers to the measures we take to moderate ourselves as ethical subjects. The fourth dimension, *telos*, means the objective of our moral behaviour (Foucault, 1994: 263–266).

Foucault's conceptualization of ethical subjectivity adds to the understanding of the ethical practices of food consumption and the CE as a moral economy by showing the concrete work consumers do to evaluate, sustain and transform their practices. Through this, it enables us to address the possibilities for consumer agency in the context of the transformation to a CE. Referring to Foucault (2003), the ways in which people form ethical subjectivity are not invented by the individuals themselves. Rather, they are based on the models suggested by society, social group, or culture (Foucault, 2003). Thus, using Foucault's conception enables us to take a look not only at the ways our participants act as individuals but also at the modes of ethical action suggested more widely in the surrounding society or culture. It also allows us to examine the limitations that practices bring to the enactment of ethical behaviour and how these difficulties in following moral

principles are justified, explained and rationalized by our participants. Referring to Shove (2010), our analysis of the transformation of the practices does not perceive our participants as 'autonomous agents of change' (p. 1279). Rather, we perceive that daily domestic conventions 'are sustained and changed through the ongoing reproduction of social practice' (Shove, 2010: 1279).

Research materials and methods

Our research material consists of participant observation in 4 leftover cooking workshops organized with the Finnish Martha organization[2] in spring 2018 and 26 food waste diaries collected from Finnish households during spring 2019. The participant observation material was collected as a part of a research project concerning the reduction of food waste on the consumer level, and the food waste diaries are part of the first author's PhD dissertation project. The workshops were documented using the EthOS mobile application,[3] designed for ethnographic research. Our research can thus be seen as ethnographically informed. However, it differs from traditional ethnographic research, since it did not include long-term field work in a 'natural' field (Emerson et al., 1995).

In any case, this kind of data enables us to observe the ethical considerations of the participants, since the cooking workshop focused on the reduction of food waste by cooking creatively from leftovers. Furthermore, while it is difficult to gain access to the participants' everyday lives through traditional participant observation at home, this method offers us a resource-efficient way of accessing the phenomenon at hand (Sirola et al., 2019). Four workshops were designed in cooperation with the Martha organization's specialist, and they lasted from 3–4 hours, with a maximum of 10 participants in each.

In addition to the participant observation material, we analyse the food waste diaries to achieve a closer view of people's everyday practices related to food in their homes – the diaries enable us to observe the participants' mundane, routinized practices. Diaries enable regularity, personality and contemporaneity in data collection (Alaszewski, 2006). Thus, the diaries enable us to analyse concrete everyday practices, rather than only observing the workshops and relying on participants' descriptions of their practices. Through these two data sets, we illustrate how consumers perform their everyday food-related practices and how they aim to modify and transform them. The diaries were kept by a casual sampling of people recruited mainly from different Finnish Facebook groups (Puskaradio Seinäjoki, Ruokahävikkiryhmä, Tampere-ryhmä, Vegaani-ryhmä) and by sharing the research call on the first author's Facebook wall. The diaries were kept for a period of 2–4 weeks by the participants.

The participants of our study are mainly women, and most live in the biggest cities of Finland. It is crucial to note that most of the participants are notably concerned about food waste and the environmental issues related to it. This emphasis in our data results from the simple fact that it is hard to get people with no interest in the subject to take part in the research. Participant

backgrounds obviously affect the ways in which they verbalize their practices, and this unavoidably has an effect on the results of our research – but it would be hard to answer our research question with data from people with little or no interest in the subject.

The quotes presented in the following section of this article have been translated from Finnish to English by the authors, with the aim of retaining as much idiomatic meaning as possible. The diary material and the participant observation material were both encoded using the Atlas.ti software. The first author of this article did the preliminary coding, and the other authors commented on the emergent findings. The codes were arranged according to Foucault's (1994) four dimensions of ethical subjectivity.

Analysis

In this section, we analyse the four dimensions of ethical work carried out by consumers in the practices of reducing food waste. Our focus is on how everyday practices enable and restrict possibilities for making food consumption practices more sustainable through ethical work on the self.

Ethical substance

The ethical substance refers to the part of the self that is perceived to need moral processing (Foucault, 1994). The ethical substance in the context of food consumption is articulated very clearly throughout the data: Current food consumption practices are perceived as wasteful and unethical, and food consumption thus has to be modified. In the data, the disposal of food is rather often described as a sin or waste. Wasting food raises feelings of annoyance, disturbance and anger. Frugality with food is seen as a moral duty. This is connected with the environmental concerns related to food waste, but it also reflects a more direct moral obligation to respect food. In the following quote, a participant describes how she perceives the disposal of food as a sin:

> [. . .] Though I have a passionate attitude towards the subject, since I think that disposing of food is a kind of sin. Climate change forces people to observe their own wastefulness. (Diary entry, a 43-year-old woman living with her 2-year-old child)

The participant recognizes that food consumption is a significant factor affecting climate change. She sees the wastefulness of people as the main reason for the state of the planet; that is, the participant considers that people have to modify their wasteful food consumption practices for environmental reasons. The participant's statement has a strong moral charge – she connects Christian ethics (wasting food is a sin) to the moral obligation to act in a way that minimizes the effects of the consumption on the climate. Thus, the reason for avoiding food waste is not the biblical virtue of frugality but instead the current ecological crisis that forces

people to observe their consumption behaviour. However, it is not enough to be aware of the problem; concrete and material actions must be taken to modify consumption (Koskinen et al., 2018; see also Evans, 2011; Southerton and Yates, 2015). Unfortunately, awareness does not often easily translate into action, as the following quotations on coffee consumption illustrate,

> In the morning, I realize, I always make 2.5 cups of coffee. I drink only one cup. This feels stupid, I have not fixed it, I've been too lazy to do that. I count this as waste. I decide to try to be better. (Diary entry 20.2.2019, a 22-year-old woman living alone)

> I still haven't learned to make less coffee. (Diary entry 23.2.2019, same person)

> Coffee still ends up in the trash!! (Diary entry 4.3.2019, same person)

The diary acts as a disrupting element that forces the participant to notice her wasteful routinized behaviour. However, as the quote suggests, turning this observation into action and actually making less coffee is not straightforward. Referring to Evans (2011), domestic conventions are intertwined with the social and material organization of everyday life. It is easy to make too much coffee because coffee is readily available and using a coffee maker is effortless. In this quote, the art of existence is formed through attempts to modify the resilient everyday reality.

The rational objective to protect the environment is not the only reason raised for the avoidance of food waste. Previous research on food waste has shown that existing cultural logics make people feel guilty about throwing food away (Watson and Meah, 2012). A large variety of emotions is often present in food-waste–related practices, such as excitement when preventing food waste by cooking from leftovers or guilt when disposing of spoiled food. In the following field note, a participant in a leftover cooking workshop describes her feelings towards the disposal of food:

> A participant tells me that soup is a dish that they usually cook from leftovers. In the winter, she does not buy tomatoes since they do not taste good and it is terrifying if they end up as waste. (A field note from a food waste cooking workshop)

The participant describes it as 'terrifying' to see food wasted. This participant does not articulate clearly why the disposal of food is so upsetting or terrifying, instead assuming that her feelings are in some way commonly shared and understood. As Reckwitz (2002) has pointed out, 'every practice contains a certain practice-specific emotionality' (p. 254). Thus, according to him, emotions are not only the internal feelings of individuals; they also belong to practices as a form of knowledge (Reckwitz, 2002). Negative feelings are part of the practice of disposing of food. Thus, in addition to the rational objective to protect the environment from the effects of overconsumption, emotions are central to the modification of food consumption practices.

Mode of subjectivation

In Foucault's (1994) conception of ethics, the mode of subjectivation invites us to recognize moral commitments, and it further refers to the ways in which individuals constitute their relation to a moral rule and recognize themselves as obligated to put it into practice (p. xxx). As our analysis concerning the ethical substance has illustrated, the matter of ethical work is unsustainable food consumption practices and the emotions connected with them. Thus, the moral rule of food waste practices could be 'do not waste food'. Based on this, the central moral commitment in our data is to avoid wasting food and thus make consumption volumes more reasonable. This has to be done in order to maintain the world that we live in – in other words, take care of the planet so that both we ourselves and future generations can live on it.

The relation to this moral obligation to avoid food waste is formed through the modification and observation of one's own and other people's behaviour. In the food waste diaries, this became particularly apparent when our participants told us about observing the actions of their family members and educating them. Many of the participants described irritation or frustration with how their family members, friends or acquaintances treated food. Thus, acting as an educator or observer is part of forming the relationship to the moral obligation to avoid wasting food. A participant describes her frustration with her children as follows:

> [. . .] The way our children treat food sometimes makes me angry. They do not scrape kettles etc. properly and always leave a little food in the bottom of the kettle. They might also take too much food [. . .] I persistently try to eat their leftovers, even though I am 100% vegetarian and occasionally on a vegan diet. I also try to remind my children that they should not dispose of food. (Diary entry, a 40-year-old woman living with her husband, three children and three cats)

It is important for the participant to train her children to consume food wisely and make a note of it if they do not act in the right way. Unfortunately, her children do not always act in the way she wishes, and she thus eats their leftovers, even though they do not fit in her diet. Through these actions, she creates her ethical relation to food. Referring to Cappellini and Parsons (2013), revaluing and consuming leftovers is a practice towards food that signals family membership. Thus, while striving for the ethical aim to avoid food waste, the participant also manifests her role as a member of the family by enacting the practice of eating her children's leftovers. In doing so, she is giving up on her other preferences in order to fulfil a greater aim.

In addition to the environmental concerns, the prevention of food waste is important for our participants because they often feel a sense of moral duty towards people who do not have enough food. According to FAO of the United Nations (n.d.), 820 million people are going hungry. Our participants often state that it is immoral to waste food while a large group of the world's population suffers from hunger. For example, one participant in the leftover cooking workshop told that she considers her wasteful food waste practices 'wrong' since 'half of the world' suffers

from hunger. Based on this, a sense of moral duty towards people who suffer from food scarcity is often central to relating to the moral rule of not wasting food.

However, care of the self and family is also deeply connected with eating practices, and this might cause contradictions between the avoidance of food waste and taking care of one's health. It is important that the family's food is not spoiled, for example, and that no one overeats. One participant in a leftover cooking workshop considers the importance of safety:

> [. . .] A participant is concerned about the safety of the food offered for the children. She would not offer the children fish after the expiration date has passed – she also says that she is very careful with what she eats, so if the food is fine for her, it is fine for the children. She also says that she sometimes calls her sister, who is a cook, and asks her opinion on whether some food item is still edible or not. (A field note from leftover cooking workshop)

In this quote, the participant points out three methods for assessing the safety of the food: expiration dates, her own assessments and her sister's expert knowledge as a cook. Assessment of edibility based on expiration dates links food to institutional governance – an authority has provided guidelines regarding the safety of the food, and, since eating spoiled fish is a great risk, the participant relies on this for certainty. Moreover, the participant's own assessment is based on her embodied knowledge regarding the safety of the food – 'If it is fine for me, it is fine for the children'. Finally, if the labelled date or the participant's own knowledge is not sufficiently reliable, she trusts her sister's expertise as a professional cook to assess the safety. These different techniques of assessment show the ethical complexity of acting with surplus food in everyday life – you cannot dispose food if you are not completely sure that it is not edible, but however, there is no room for mistakes regarding food safety when you cook for your family.

Thus, the way the relation to the moral obligation to avoid wasting food is formed has much to do with the unpredictable and complex nature of everyday life. In addition to the avoidance of food waste, there are several other demands that shape everyday requirements related to food, such as caring for children. As Meah and Jackson (2017) have pointed out in their research concerning care and convenience, care can be manifested in many ways, and these manners of expressing care do not all cohere with normative beliefs regarding the 'right' ways to, for example, take care of one's health or environment. Thus, the relation to the obligation not to waste food has to be formed in a flexible manner. The need for this flexibility might emerge, for example, from the production of food waste resulting from the unpredictability of how much the children will actually eat. In our data, this has usually been accepted as an unavoidable part of everyday life. A participant describes a frequent situation in her 2-week diary:

> I threw away rice that was left on my child's plate, and when we were having supper, I threw away a half slice of bread that my child did not eat. I did not feel anything

> while doing this, since the food waste was not avoidable. (Diary entry, a 43-year-old woman living with her 2-year-old child)

Child care sometimes leads to food waste, and the participant's acceptance of this is manifested through her statement that she did not feel anything while discarding her child's leftovers. This was because the food waste was not avoidable. Obviously, being a good parent does not involve pressing your children to eat too much.

The willingness to take care of oneself by following a healthy diet can lead to food waste as well. For example, one participant describes in her diary how in their household, most of the food waste results from the jars of food stored in the refrigerator, such as pastes, mayonnaise and jam. She explains that these foods usually spoil, since she and her spouse do not eat them regularly, and thus get discarded. In these situations, the commitment to healthy and diverse eating overtakes the moral obligation not to waste. As Evans (2014) has brought out, convention dictates that people should eat properly, and eating mayonnaise and jam every day or pressing children to eat too much does not fit into 'a proper diet'. All in all, even though there is a moral commitment to prevent food waste, these unpredictable and ethically 'messy' situations illustrated by our participants show how the relation to the moral rule against wasting food is not formed straightforwardly. Instead, it is affected by multiple and sometimes contradictory ethical sensitivities, moral obligations, practices and conventions.

Self-forming activity

Self-forming activity means the techniques we use to become ethical subjects (Foucault, 1994). Our participants pointed out several techniques for modifying their behaviour. These are often different techniques to disrupt the wasteful habits rooted in everyday life, such as notes hung on the refrigerator, remedies learned from the Internet, friends, or family, and an overall sense of respect towards the food. In the leftover cooking workshops, participants described that the attitude towards food is very important – you should respect food and not be too picky. However, eating leftover food does not have to be unpleasant at all. Cooking skills and creativity are the key practical techniques to make leftover food desirable and aesthetic. A participant describes how she cooked from leftovers:

> There were some salad, sliced raw red cabbage, and a couple pieces of roasted carrot left from yesterday's meal. At lunchtime, I added some tomatoes, sweet pepper, and leafy greens to the meal. I fried the red cabbage and carrots in a pan with seitan kebab. In addition, I cooked some broccoli from the fridge. (Diary entry, a 34-year-old woman living with her spouse)

The participant knows in detail the ingredients that were left from yesterday and what is needed to cook a new meal using them. Her actions show her knowledge,

skills and creativity in cooking. In the data, participants often write that leftover food actually makes cooking easier, since you can just add some new ingredients to an almost-ready meal. In one of the leftover cooking workshops, the participants also stressed the importance of aesthetics in cooking and serving the leftover food. They claimed that beautiful-looking food even tastes better. This is part of the constitution of the ethical self: Food waste is avoided, but in a manner that is pleasant.

However, leftover food is not always beautiful or aesthetic. Leftovers are sometimes eaten out of a sense of responsibility, not for pleasure. For example, eating children's leftovers was rather usual for our participants. A participant describes how he tries to avoid food waste when cooking for his two children:

> I try to cook my children the kind of food they like, and if they do not eat all the food from their plates or they have taken it too much, I usually tell them to leave their plates on the table, and I then eat their leftovers. (Diary entry, a 51-year-old man living with his two children)

The avoidance of food waste requires knowledge of family members' preferences. Previous studies on food consumption show that feeding children is demanding work – the food provided cannot be just any food; it has to satisfy the family (DeVault, 1991: 40). Furthermore, eating children's leftovers is a practice that shapes the family's relations – you would not eat leftovers from a stranger's plate, and it is usually one of the parents who eats the leftovers. Eating leftovers is thus an expression of affection (Cappellini and Parsons, 2013). Based on this, in this quote, eating the children's leftovers constructs the ethical self in relation to food and family. This quote does not tell whether this is pleasant for the father or not, but in some parts of our data, food is eaten rather than discarded even if it is unpleasant. In these situations, disciplined elements define the ethical actions in relation to food. A participant describes eating spoiled food:

> I ate the food that was left at room temperature overnight, and now my stomach hurts . . . It was worth it anyway, since I left the food there myself. (Diary entry, a 26-year-old woman living with her husband and dog)

In the quote above, the participant seems to consider that she is responsible for letting the food spoil and thus it is morally right to suffer from the illness that is caused by it. Thus, the mistake of forgetting the food on the table is compensated by taking the risk of falling ill. The sensitivity and intimacy of eating are revealed in a very harsh manner when the food we eat makes us fall ill. However, it is not that usual in our data that the participants would eat spoiled food. Because of the risks and disgust, we have a need to separate from spoiled food to maintain our self, our own being. Thus, it is also important to note that discarding the food that is not edible is an ethical act that constitutes the self (Hawkins, 2006). Based on this, disposing of spoiled food is an inseparable part of domestic practices (Evans,

2011) and cannot be defined only as 'unethical' or careless behaviour. Even though wasting food is morally problematic, separating from the spoiled food can be a revealing experience:

> We cleaned our fridge and disposed of a bit of spoiled yoghurt, the remainder of the iced tea, a couple of mouldy sweet potato balls, a bit of tofu, and a last piece of pastry forgotten in the fridge. Cleaning the fridge felt good, even though it is a pity to throw food away. (Diary entry, a 26-year old woman living with her spouse and dog)

In the above quote, separating from spoiled food cleanses the personal environment and the self. This kind of need to separate from the spoiled and dirty food is a technique of the ethical self that might sometimes be contradictory with the moral logic of the CE. The disposal of food is unpleasant and problematic, but it is sometimes necessary. Thus, the practices related to our conceptions of cleanliness might sometimes contradict with the ethical aim to prevent food waste (Hawkins, 2006). Moreover, conventions related to cleanliness, such as keeping the refrigerator free of spoiled products, are a normalized part of everyday practices (Shove, 2003). Thus, disposal is also significant for the practices of forming the ethical self (Hawkins, 2006). Most of our participants have the option to recycle their food waste with their condominium's biowaste recycling bin. However, some of the participants have their own compost bins. A participant tells about her recycling habits:

> My relationship to shrivelled carrots and dried bread might be of interest to you: I think that they are material for my bokashi compost bin. They will transform into self-made, nutritious soil for my vegetable garden. They are not worthless waste. I use the bokashi around the year, and I use my condominium's biowaste bin only for the waste that emerges from my dog's meat-based foods, such as chicken legs. Thus, the carbon emissions are really low, since using bokashi is a closed-circle activity. (Diary entry, a 67-year-old woman living with her three dogs)

The quote above shows how different recycling practices transform the relation to food and moreover the ontology of the food itself: The food that cannot be used as human nourishment turns into nourishment for plants that are to be eaten. This constitutes a closed circle for food waste. Here, food waste is not shut out of the personal environment to the system of waste management; instead, its transformation becomes part of the daily routine. Thus, some new technologies and material arrangements of living with food waste have potential for transforming food waste practices towards the acceptance of waste, rather than its avoidance (Hawkins, 2006).

Telos

Telos refers to the ultimate goal of the moral behaviour (Foucault, 1994). In our data, climate change is sometimes explicitly given as a major influence on the

willingness to transform wasteful food consumption practices. However, the reasons for the willingness to avoid food waste are not usually stated clearly or explicitly in our data – instead, participants often merely say, for example, that avoiding food waste is important for them, that they have learned at home that food does not belong in the bin, that they avoid food waste for ethical reasons, or that they have an 'inner will' to avoid food waste. The following quote illustrates this in more detail:

> When asked about the reasons for participating in the leftover cooking workshop, the participant responds that she felt a sense of responsibility towards the subject. (A field note from a leftover cooking workshop)

It seems that the appreciation of food by not throwing it away is a moral aim that connects the food to several different factors, such as environmental concerns, care for distant others, and overall emotional commitments related to food. Thus, we define the *telos* of the moral behaviour as 'becoming a responsible citizen by avoiding or recycling food waste' in the context of the CE. In more detail, such a 'responsible citizen' aims to create a balanced relationship to the self, other people, and the environment. Through this, the aim is to create a thrifty ethos by doing everything that is possible to avoid the disadvantages of food waste. The following quote illustrates this:

> Avoiding food waste has always been important for me. If I go to a restaurant and do not eat all of the food, I always take the leftovers with me. I buy only as much food as I eat. 10 years back, I was a regular dumpster diver, due to my small income and environmental reasons. It felt at the same time good and bad to find raw fruit and cakes in neighbours' bins. (Diary entry, a 32-year-old woman living with her rabbit)

The prevention of food waste is not limited only to the above participant's own domestic practices. Utilizing other people's waste through dumpster diving reveals objects that have been shut out, such as raw fruit and cakes. The participant writes how it felt simultaneously good and bad to find completely edible food from the bin: It is nice to find something useful, but at the same time it reveals the magnitude of wastefulness. Dumpster diving is a radical practice that constitutes the relationship to food and waste in a completely different way from the usual practices of use and disposal. The participant presents herself as a responsible consumer who does everything possible to avoid food waste. She thus points out the practices through which she aims to constitute herself as a responsible citizen in the context of the CE.

Concluding discussion

Based on Foucault's ethical theory, our analysis has explored through four different dimensions how the work on ethical subjectivity enables the transformation of

food consumption practices into more sustainable and circular ones. Foucault's theory on ethical subjectivity, in combination with practice-theoretical research, provides a useful analytical framework for consumer researchers to address various aspects of ethical consumption, including energy consumption or air travel. Furthermore, the CE literature currently lacks in-depth understanding about consumer culture, which provides consumer researchers an opportunity for cross-fertilization, following the path set by this study.

Our analysis reveals that the ethical substance in our data is the unsustainable food consumption practices and the emotions related to them. Both are modified through ethical work. However, habits are sometimes rooted deeply in everyday routines and thus are not always changed easily. Our analysis suggests that the transition to a CE cannot be carried out only by teaching consumers the 'right' way to do things and providing infrastructures to implement the CE – rather, changing consumption practices is a process of constant transformation and modification.

Moreover, the mode of subjectivation to the moral rule not to waste food is formed through observing and acting as an educator to the family and others. Our participants felt a moral conviction to avoid food waste for environmental reasons and because many people live with a shortage of food. However, as our analysis suggests, concerns about the safety and healthiness of the food, as well as the unpredictability of everyday life with children, result in competing moral principles. Thus, the relation to the moral obligation to avoid food waste has to be formed in a flexible manner.

The self-forming activity in our data is based on creativity, skills, learning new things, anticipation and a right attitude towards food. The creative practices of living with excess food bring joy to everyday life, but however, avoiding food waste also sometimes involves strict self-discipline. All in all, the self-forming activity aims to transform the food consumption process through different techniques of disrupting wasteful consumption practices. However, separating from food waste is also crucial for forming the ethical self. Finally, based on our analysis, the *telos* of the ethical action is to become a responsible citizen in the CE. Through the ethos of thrift, the aim is to create a balanced relationship to the self, others and the nature.

In contrast to those sampled in our data, it is crucial to note that there are plenty of people who are not interested in transforming their practices into more sustainable ones. This is problematic, since the transition to a CE requires, that consumers take the CE as their moral project. It would also be important to research the practices of people who are not that concerned about the sustainability issues of food consumption.

It is crucial to note that if we want to take seriously the moral complexity of everyday life, we cannot assume the CE as a moral economy of simple 'rights' and 'wrongs'. Thus, we must consider that if we want to have a clear view of the CE, we cannot perceive the role of citizens only through the acceptance or rejection of practices that have been designed on their behalf (Hobson, 2016). This is in line

with Mylan et al.'s (2016) notion that 'consumption in the home is far more complex than securing the "right" flow of goods and disposing of the waste in the "right" way' (p. 10). Thus, the discourse on the CE should not slip into moralizing and blaming overspending consumers (Evans, 2011). Instead of such sanctimony, it is important to pay attention to the need for changes in political decision-making and our whole way of life.

Finally, we want to present some possible policy implications related to food waste reduction and the implementation of the CE. Political programmes, such as the EU's CE Strategy mentioned in the 'Introduction' section, appear quite distant from the perspective of everyday life. Thus, more local initiatives to promote the CE are needed. The leftover cooking workshop organized with the Finnish Martha Organization and food waste diaries that were used as research material in this article provide examples of this kind of local means of influence. Finally, although we do not claim that current volumes of disposal are reasonable, our results are in line with sociological research's findings that disposal and waste are necessary for the enactment of domestic practice (Evans, 2011). This is an inescapable impediment to the CE's ideal of ending the production of waste.

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Notes

1. However, our aim is not to claim that all people live in abundance of food – scarcity is part of everyday reality for many people (FAO of the United Nations, n.d.).

2. The Finnish Martha organization was founded in 1899 to promote education regarding home economics, mainly related to food and nutrition, home gardening, and environmental protection, as well as household economics and consumer issues (The Finnish Martha Organization, n.d.).
3. EthOS is an ethnographic observation application available for mobile phones. It allows users to create field notes and add pictures and videos taken and recorded in the field.

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PUBLICATION III

Biowaste as fluid matter: Valuing biogas and biofertilisers as assets in the Finnish biogas sector

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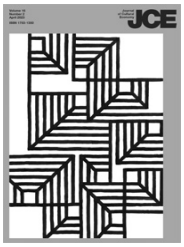

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Biowaste as fluid matter: valuing biogas and biofertilisers as assets in the Finnish biogas sector

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ABSTRACT

In this article, we examine the effort of turning biowaste into an asset in the everyday practices of Finnish biogas plants. Drawing from social scientific waste studies as well as new materialist and posthumanist approaches, we approach biowaste as unruly, *fluid matter* inclined to leak and spill over and capable of affecting the possibilities of valuing it. Our analysis shows how biowaste resists the efforts to turn it into completely homogenous mass; how this mass has to be taken care of over the production process; and how it is not always clear whether the practices produce valuable assets or problematic excess. We argue that to better understand the possibilities for a transition towards a circular economy, it is important to acknowledge that the processing and valuing of waste does not offer complete control over it, but also requires careful alignment with waste material that does not always act as wished.

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Introduction

> The floor of the building used for preparing biowaste for further treatment is covered by dark brown, smelly goo – the decomposing biowaste that has spread on the floor. The biowaste has been shovelled from the storage room to the pretreatment machine called the Cow. At the moment, there is also a lot of foam on the floor overspilling from the 'kettle' used for treating sewage sludge. Amongst the goo and the foam one can spot few objects that are still recognisable as carrots, cutlery, red onion, and torn beverage packages, for example. (Field diary entry, 24 May 2021, Southern Biogas LTD)

The above entry is written on the first day of field work in a Finnish biogas plant, situated just outside a smallish, quiet town located in Southern Finland. The plant treats both biowaste (collected for example from municipalities and food industry businesses) and sewage sludge. The described scene illustrates the transformation that food once defined as worthless waste undergoes when it is transported to the biogas plant. There are items that are still identifiable as vegetables, for example, just like there are objects, such as shreds of food packaging and scratched cutlery, that should not be there in the brown lime in the first place, but most of the stuff has already started to decay and turn into smelly slurry. For the most part, the material has transformed into an anonymous, general mass that bears hardly any traces of the objects that have gone into it or reveals the connection to the practices that have produced the discards, such as disposing of leftovers in homes or spoiled products in supermarkets (Figure 1).

Simply put, biogas plants like this one treat organic waste to produce renewable energy, namely, biogas and biofertilisers, from it. For the plants, biowaste[1] amounts to a valuable resource and not simply a matter of concern. That biowaste and especially the end products of the biogas production

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Figure 1. Cutlery and fruit peels on the floor of the biowaste pretreatment hall.

process can be regarded as assets in the first place, that is, as 'something that can be owned or controlled, traded, and capitalized as a revenue stream, often involving the valuation of discounted future earnings in the present […]' (Birch and Muniesa 2020, 2), is conditioned by the adoption of the circular economy (hereafter CE) as an economic rationale and business model. As a response to the unsustainable linear economic model of take-make-use-dispose that is met with the constraints on the availability of resources, the CE aims, for example, to reduce, reuse, repair and recycle materials 'to close the loops,' recover energy from waste, and decouple economic growth from the use of virgin natural resources (see e.g. Geissdoerfer et al. 2017; Ellen MacArthur Foundation n.d.).

The somewhat technocratic CE discourse of turning waste into an asset has, however, been problematised from many angles (see e.g. Corvellec, Stowell, and Johansson 2022). For example, waste scholars have pointed out that the CE is far from being an uncomplicated technical system; it is, rather, constantly produced in concrete and mundane hands-on practices that entail leakages and disruptions (Holmberg and Ideland 2021; Lehtokunnas and Pyyhtinen 2022). In this article, we examine such practices of making circularity through turning biowaste into assets like biogas and fertilisers at Finnish biogas plants. In the endeavour, we draw from the pragmatist approach to value as valuation, according to which no object is valuable as such, but its value is enacted in practice (Dewey 1939; Greeson, Laser, and Pyyhtinen 2020; Muniesa 2012). However, instead of understanding biowaste only as a passive intermediary for creating value at the plants, in line with new materialist and posthumanist perspectives (e.g. Barad 2007; Bennett 2010) we attend to how also biowaste itself actively affects the possibilities of valuing it. To explore these issues, we ask: *through what kind of concrete, hands-on valuation practices may biowaste turn into an asset*

in everyday operations of biogas plants, and how does waste participate in or complicate these practices?

The article contributes empirically to the field of social scientific waste studies (e.g. Douglas 1966; Thompson 1979; Hawkins 2006; Greeson, Laser and Pyyhtinen 2020; Gregson and Crang 2010; Gille 2013; Holmberg and Ideland 2021) by focusing on the making of circularity, and theoretically to the field of material studies (e.g. Stocking 1985; Appadurai 1986; Miller 1987; Graves-Brown 2000; Hetherington 2003; Miller 2005; Hicks 2010) by shifting the focus away from waste as a clear-cut object or entity to approaching it as *fluid matter*. We employ the metaphor of fluidity which we take from Marianne de Laet and Annemarie Mol (2000) to underline the relationality and processuality of waste (for other contributions addressing waste as fluid and mutable, see e.g. Alexander and Sanchez 2018; Crang et al. 2013; Lepawsky and Billah 2011; Liboiron 2016). The boundaries between valuable asset and worthless waste are not fixed, but rather transient and situational; the *whatness* of the material is dependent on its *whereness* (see also Pyyhtinen and Lehtonen 2021). Secondly, in contrast to the common object-centred or oriented tendency in material studies, by focusing on biowaste as *fluid matter* instead of *fluid object*, like de Laet and Mol (2000) do, we wish to highlight how not all that is material is imprisoned within objects.

Our research materials were generated by way of fieldwork conducted at two Finnish biogas plants: the Southern Biogas LTD and the Western Biogas LTD (both company names are pseudonyms). In addition to ethnographic observation at the two plants, 11 semi-structured interviews were conducted with experts in the biogas sector and staff members of altogether seven different Finnish biogas plants. The article is organised as follows: First, we will provide a brief description of the current state of biogas production in Finland as part of the national CE transition goals and provide justification for the selection of our sites. Then we will present the theoretical background and materials and method of our research. After this, we move on to our analysis, in which we analyse how biowaste is first turned into more or less homogenous mass; how this mass is taken care of; how the mass itself affects how it can be valued; and how the valuation of biowaste that is transformed into biogas and biofertiliser is entangled with and limited by societal and economic relations. Finally, we will present our conclusions.

Background: Finnish biogas production and the sites

The CE is high on the political agenda both in the EU and globally. Championed by such important agents as the European Commission, multinational companies, management consultancies, NGOs, and academics alike, the CE is identified as a pathway toward a more sustainable society and is expected to promote economic growth by creating new businesses and job opportunities, increasing resource productivity, and bringing net savings (EU Commission n.d.).

Finland has laid great emphasis on the transition towards a CE during the last decade (Åkerman, Humalisto, and Pitzen 2020), and one goal related to this is to develop the operational environment of Finnish biogas plants. Currently, the potential income from biogas and fertilisers is rather low in the country, and this creates insecurity and commercial viability for the business operations of Finnish biogas firms (Valve, Lazarevic, and Humalisto 2021). The potential income from these products has been low due to the low electricity prices in Finland, the costliness of infrastructure investments that would enable plants to distribute gas efficiently, and the underdeveloped markets for biofertilisers, among other things (see e.g. Winquist 2019). Currently, the business models of Finnish biogas plants are dominantly, but not exclusively, based on the so-called gate fee, which means that the businesses are dependent on the processing fee they charge their customers for the waste management services that the companies provide them (see also Åkerman, Humalisto, and Pitzen 2020; Valve, Lazarevic, and Humalisto 2021).

In Finland, all recycled biowaste is either composted or treated at biogas plants. At biogas plants, the biomasses are handled through a treatment process called anaerobic digestion in which microbes break down organic material, releasing biogas from it as a result. The digestate that comes out from the biogas reactor when microbes have broken down the biowaste can be used as a fertiliser as such or

reprocessed for a certain use. Currently, there are approximately 80 biogas plants that treat different biomasses (such as biowaste, manure and sewage sludge) operating in Finland (Suomen biokierto ja biokaasu ry n.d.). Some of these plants are owned for example by animal farms that produce biogas from manure, and others by municipalities or private or state owned companies.

The two biogas plants where the fieldwork was conducted were selected as sites of this research, because both of them treated biowaste collected from various sources: households, retail stores, and food industry businesses. By this we wanted to get at how the waste valuation practices at the plants are connected to waste generation at multiple sites along the food chain. It was also useful to conduct the research at plants that differed in their size, location, modes of distributing the end products, and to some extent also values. Southern Biogas LTD was larger both in terms of their production volume and the number of employees. The most crucial difference as to their modes of distributing the biogas was that Southern Biogas LTD produced biogas for traffic use, while Western Biogas LTD did not sell biogas for traffic use at all at the time when the fieldwork took place. Otherwise, the modes of distributing gas were rather similar: the gas that was generated was used to produce heat and electricity.

Theoretical framework

The making of circular economy and fluid matter

The idea of the CE, as Gregson et al. (2015) note, is 'more often celebrated than critically interrogated'; the use of the concept 'in both practitioner and academic literatures tends to be approbatory, uncritical, descriptive and deeply normative.' It is, however, important to subject the CE to critique, given its prominence in academic, practitioner, and policy spheres and discourses. Scholars have stressed that while there is a strong political will to make waste circular, accomplishing it in practice is often far from being simple (Gregson et al. 2015; Corvellec 2016; Corvellec, Stowell, and Johansson 2022). Researchers have also undermined the idea of a perfect circle (Žižek 2010; Skene 2017; Valenzuela and Böhm 2017) and pointed out that CE policies focus mainly on technical solutions and industrial systems; the socio-cultural change that the CE requires in the everyday practices has received less attention (Hobson 2016). Recently there has been a rise in studies problematising the possibilities of creating circular practices at the level of everyday life (Hobson 2016; Holmberg and Ideland 2021). The research done on mundane practices of making circularity has, however, mostly (but not exclusively) focused on consumer practices; other parts of the consumption-production system have not received equal attention.

In this article, we approach the CE in pragmatic terms, by paying attention to how it is enacted and made to be in everyday practices at the biogas plants. The practical enactment of the CE is also nicely addressed by the concept of 'make-up work' coined by Holmberg and Ideland (2021), with which they illustrate how CE policy is performed in practice, and how the practices of turning waste into resource through, for example sorting and cleaning, also generate new waste. For Holmberg and Ideland, the concept of make-up work exemplifies how the interruptions and leaks were handled along the waste treatment process in the Swedish biogas plants that they studied (Holmberg and Ideland 2021). Somewhat similarly, in our analysis, we are interested in how the circularity of biowaste is made in concrete, hands-on practices performed by experts. However, we also go beyond this view by highlighting how accomplishing circularity is not up to people and their practices alone. Waste itself plays a part in how it can be manipulated and what it can be turned into. In doing this, we explore the desired and undesired changes that the materials fed into the process go through, and how these changes complicate the possibilities of working with them and valuing them.

To inquire into the vague boundaries between value and waste, we highlight the *fluidity* of biowaste. In their well-known analysis of a Zimbabwe Bush Pump, Marianne de Laet and Annemarie Mol (2000) examine the pump as a 'fluid object,' by which they mean that it is not 'well-bounded but entangled,' it 'doesn't impose itself but tries to serve,' and it is 'adaptable, flexible and

responsive' (227, 226). Like de Laet and Mol, with the metaphor of fluidity we wish to emphasise the vagueness of boundaries and the relationality and processuality of waste. In the processing of biowaste, the boundaries between valuable asset and worthless waste are not fixed, but vague, transient, and context-dependent (see also Greeson, Laser, and Pyyhtinen 2000; Lehtonen and Pyyhtinen 2020).

However, to us, biowaste also exemplifies other characteristics of fluidity not embodied by the Bush Pump. First of all, as our analysis will show, while to some extent also being flexible, mutable, modifiable, and responsive, biowaste also presents a form of *unruly* matter that undermines and easily escapes human control (see also Reno 2015; Doeland 2019). It is not merely a manageable object, but it spills over, leaks, expands, spreads, smells, decomposes, decays, and tarnishes, and thereby also invites us to venture beyond the good and wanted agency of matter. Secondly, we examine biowaste as fluid *matter* (instead of as a fluid object) to suggest a reorientation in the approach to materiality. Not all that is material resides in objects (see also Pyyhtinen 2015). Even in the cases when matter assumes an object form, it goes through constant movement, variation, and renewal. The seemingly im/passive and fixed solid object closed in upon itself only momentarily imprisons the material flows within its organised form, only to disintegrate later and join new assemblages; objects are already crystallised out from the flows of materials and their transformations (Ingold 2011, 2013). In the process of its rendering into an asset, biowaste is at once *more-than-object* and *less-than-object* (cf. Pyyhtinen 2015). It is 'more' in the sense that it is not a clear-cut, well-bounded, and isolated object but entangled both in its nature and performance: it is connected, for example, to contracts between the biogas plants and their customers, to the prevailing waste management infrastructure, to political decisions, and to the economic, technical, and social context of society at large. This latter aspect is also highlighted by de Laet and Mol's analysis of the Bush Pump. However, while the Bush Pump is also a solid object, biowaste is not; it is 'less' than an object insofar as it is rendered anonymous mass at the plants. This means that its characteristics as a clear-cut object are stripped away and it is turned into a general, unidentifiable mass.

Valuing waste as an asset

Currently, the valuation of biowaste in biogas plants significantly involves the 'valuation of discounted future earnings in the present' (Birch and Muniesa 2020, 2). As we mentioned above, biogas and fertilisers that the plants produce do not generate enough revenue in the present, and thus Finnish plants are dependent on the gate fees that they collect. It is however hoped that selling these products may create a revenue in the future. Here, value and the valuing of biowaste result from the process of *assetization* (Birch 2017), that is, from turning things into assets. An asset is not simply a commodity that can be sold, but it is rather an object that creates an income stream. Kean Birch (2017, 468) illustrates this by taking music copyright as an example: while a particular saleable item, such as a CD or an LP, is a commodity, music copyright is not a commodity but an asset that creates a continuous revenue stream to its owner. Closer to the subject at hand, carbon credits and the related certifications can be seen as assets, since they are not simply commodities produced for sale (Birch, Ward, and Tretter 2022).

In the same way, making power purchase agreements or other kinds of contracts with customers creates a revenue stream for energy producers, such as biogas plants. What is more, activities such as financial support granted by the state (for innovating new technology to create novel uses for biogas and fertilisers, as well as different certificates that verify that the energy is produced from renewable resources) are essentially entangled with the assetisation process of biowaste – only agents fulfilling certain criteria are given access to these benefits that contribute to the valuation of the end products. Thus, products created from biowaste entail specific modes of ownership and control as well as technoscientific expectations that are related to their qualities as renewable material and energy (Birch and Muniesa 2020).

In examining the assetisation of biowaste, we follow the movements of value orchestrated in the everyday practices of the biogas plants. We do not treat value as something that would lie inherently in biowaste and the products produced from it. The materials are made valuable in practice, for example in the hands-on processing of biowaste at the plants, and when biogas producers try to tinker the production process to create new markets and uses for biogas and fertilisers. Theoretically, we draw here from the pragmatist approach to value as valuation (e.g. Dewey 1939; Muniesa 2012; Birch 2017; Greeson, Laser, and Pyyhtinen 2020; Lehtokunnas and Pyyhtinen 2022; Lehtonen and Pyyhtinen 2020). However, in the everyday operations of the biogas plants, it is not always perfectly clear whether the practices produce waste or value. Thus, we also aim to show that the perfect management of biowaste or its value is not possible: practices that create value always also produce waste (Greeson, Laser, and Pyyhtinen 2020; Lehtonen and Pyyhtinen 2020). What is more, managing and valuing waste is not only a result of human mastery over matter, but it involves working with and joining forces with materials and non-human entities which actively participate in the treatment processes at the plant, which may sometimes have unexpected consequences.

Therefore, we hold that when analysing the valuation of biowaste as an asset, it is important to pay attention to the activity and dynamism of waste matter. While waste scholars have taken an interest in materiality (Moore 2012), more often than not they have tended to portray discarded objects as more or less passive and inert, just waiting to be endowed with meaning and handled by humans. In contrast to this socio-constructionist approach (most famously Douglas 1966; Thompson 1979), and inspired by new materialist and posthumanist perspectives (e.g. Barad 2007; Bennett 2010; Coole and Frost 2010; Braidotti 2019), some of the more recent inquiries within the field of waste studies have turned the focus on the effects of waste matter itself (e.g. Hawkins 2006, 2009; Gabrys 2009; Gregson and Crang 2010; Hird 2012; Gille 2013; Van Bemmel and Parizeau 2020). Gay Hawkins (2006, 4–5), for example, has stressed the affective capabilities of waste matter, suggesting that

> to reduce waste to an effect of human action and classification is to ignore the materiality of waste, its role in making us act; the ways in which waste is both a provocation to action and itself a result of that action.

Along similar lines, we examine biowaste materials as in themselves active and effective, able to '*have a say* in what they become' (Hawkins 2013, 56), and how biowaste becomes effective in its relations to humans and non-human others. For example, the microbes in the biogas reactors as well as the functioning of the technology and the infrastructure affect in a very concrete way how everyday operations can be organised at the plants and how and what kind of waste it is possible to circulate and value.

Materials and method

The materials of the article consist of three weeks (75 h) of participant observation and 11 semi-structured interviews conducted by the first author. The materials were collected during Spring and Autumn 2021. The ethnography was conducted at two biogas plants, Southern Biogas LTD and Western Biogas LTD located in Finland. During the observation periods, the ethnographer spent 5 h per day at the plant and observed daily tasks, such as cleaning, sample taking, and maintenance work. Occasionally she herself also took part in some simple work tasks. Short jottings were written during the days at the plants, and more detailed field diary entries (79 pages in total) were written at the temporary accommodation after each day in the field. All the employees that participated in the research signed a research agreement.

In the ethnographic observation, we were not so much interested, for example, in the biogas plant as an organisation or in the social relations between the staff members as in the routinised, everyday practices that contribute to the operation of the plant and to the valuing of biowaste. During the observation period, the ethnographer became familiar with the biogas production process on a mundane level and got to know the everyday routines. Ethnographic interviews were conducted alongside observing the operations.

To top up the ethnographic observations and the interviews conducted *in situ*, a number of additional interviews (11 in total) were conducted with staff members of seven Finnish biogas plants that process biowaste, and with two experts working in the field. Most of the participants worked as managers or experts, but some of them also participated in practical work tasks at the plants, such as maintenance. Each interview lasted approximately for one hour. With the interviews, we were especially interested in finding out more about the conditions that make the operation of biogas plants possible in the Finnish context, and about potential disruptions in their operations: for example, how the steady flow of feedstock is secured, what are the possibilities of building new infrastructures, and how the end products are moved forward.

The analysis of the data (both the interviews and the field diary) was conducted through thematic coding. The analysis is mainly built on the observations in the field; the interviews were used to connect these observations to a bigger picture of the Finnish biogas sector. First, the key themes that recurred in the data were identified through a systematic reading of the data and then highlighted. The themes of assetisation and valuation guided the reading of the data. The next step consisted of encoding the key themes by using the Atlas.ti software. After this, based on the ethnographic fieldwork, the researchers divided the different phases of the production process of the plants in three simplified clusters: firstly, getting waste in and pretreating it; secondly, monitoring and taking care of the process; and, thirdly, selling the end products. In the analysis, the production process is described on a fairly general level. A fine-grain description would compromise our attempt at theorising fluid matter and contributing to discussions on materiality; the unavoidable price of generating theoretical abstraction is the loss of nuance (see Healy 2017).

Analysis

Sorting and anonymising incoming biowaste

In the first section of the analysis, we focus on the efforts of biogas plants when they process the incoming waste. The biogas plants (as well as many other CE businesses) are able to operate and receive waste thanks to certain waste governance practices that oblige households and businesses to recycle their waste. When biowaste is entangled with certain waste governance practices and contracts that are crucial for the CE, it is enacted as more-than-object.

While the circular practices of households and businesses condition the operations of biogas plants by feeding them with incoming waste, the connectedness of the waste to consumption and production practices is effaced during the production of biogas and biofertilisers. This was discernible in most concrete terms at the plants: before waste was fed to the reactors where microbes start breaking it down, it was crushed, sorted, and rendered into an anonymous, indistinct mass.

The ethnographer got to observe how the production process started with moving biowaste from the storage space into the pretreatment machinery that crushes the waste and tears off the plastic and metal packaging from it. At Southern Biogas LTD, there was a large hall for storing incoming biowaste, and the waste was piled on the floor of this hall. At Western Biogas LTD, by contrast, the waste transport companies dumped the incoming waste into a 'pool' that was cast into the floor of the waste reception hall. Usually during the shifts, there was one employee responsible for running the pretreatment process. At Southern Biogas LTD, the employee responsible for the process fed the feedstock to the pretreatment machinery by using a tractor. At Western Biogas LTD, the feeding was carried out by using a remote-controlled hoisting machine. While doing this, the worker responsible for the task also monitored the process by checking the surveillance cameras and listening and observing the machinery to ensure that things ran smoothly.

The pretreatment and sorting of biowaste imposes several requirements on the machinery of a plant, since a large quantity of the biowaste arriving at the plants is originally packed in plastic packages or metal cans. The plant has to remove unwanted contaminants from the incoming biowaste, and sorting practices are key to accomplishing this. Households often pack their biowaste

into biodegradable plastic bags, and even though these bags are specifically designed for recycling biowaste, they are not perfectly suitable for the processing of the incoming waste at biogas plants. Moreover, the biowaste collected from retail stores and food industry businesses often arrives at the plants still packed in its original wrapping, and also other contaminants, such as sand, may end up among the waste. All these objects have to be mechanically removed from the waste and the mass needs to be crushed before the waste materials can move further along the process. The machinery contained for example a 'screw' which was used in this make-up work of mechanically extracting plastic and metal from the biowaste mass to which they did not belong (Figure 2). Here, the solid biowaste packed in plastic or metal is not yet valuable for the plant as such, but it has to be made valuable through concrete practices of sorting, separating, and crushing. The biowaste is rendered less-than-object in a very concrete process of transformation: once contaminants like cutlery, plastic packaging, and sand have been removed, biodegradable items like carrots, onions, meat, bread, and fruit are turned into browish, smelly mass by the pretreatment machinery. The indistinct, homogeneous mass that results from the process no longer bears any resemblance to the objects that have gone into it.

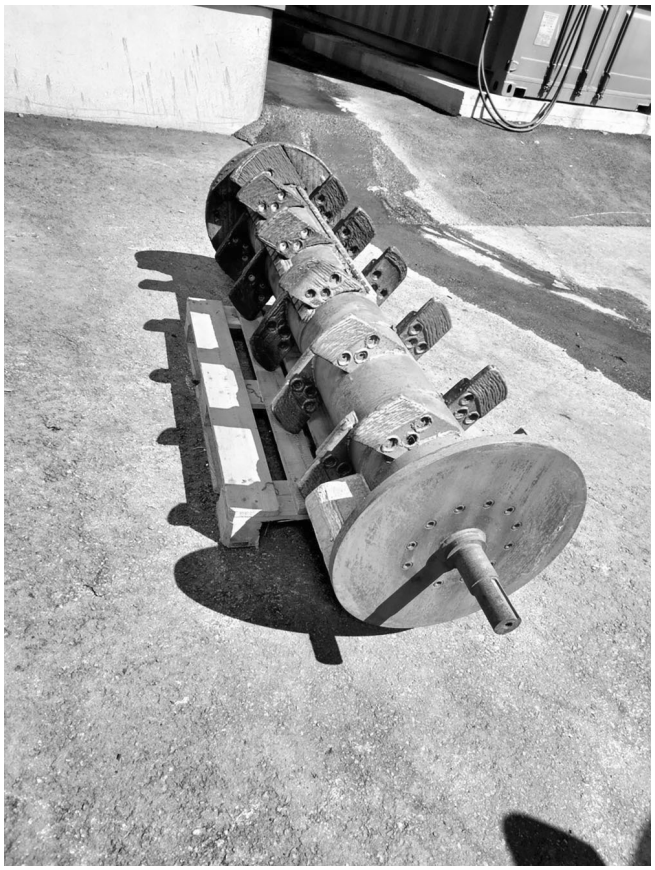

Figure 2. A worn 'screw' used in biowaste pretreatment machinery to separate plastic and metal from biowaste.

While being essential to the assetisation of biowaste, the aforementioned practices of sorting, separating, and crushing nevertheless seldom succeed in completely mastering the composition of biowaste (see also Gregson and Crang 2019), and thus the biowaste also resists its valuation practices. Even if the plants constantly aim to optimise the operation of their plastic, sand, and metal separation machinery, such contaminants as small pieces of plastic may nonetheless remain in

the slurry, creating potential blockages in the pipes and occasionally even causing the mechanical parts of the plant machinery to break down. Over time, contaminants such as plastic or sand also inevitably gather inside the reactors:

> A plant worker shows me the inside of a sludge tank that is under construction and says that once one of the reactors was almost full of sand. It had taken them weeks to restart the process even after the reactor had been emptied. Emptying a reactor is expensive, because the production process is brought to a halt and they need to order specific machines capable of completing the task. (Western Biogas LTD, 3 June 2021)

Objects and materials, such as sand and plastic, that do not belong to biowaste thus disturb the production process and generate extra costs. What is more, the plastic wrappings and packages that are separated from biowaste during the pretreatment process usually cannot be recycled, mainly because some of the packages may also contain other materials in addition to plastic, and the mechanical separation process also severely damages them. Because of the poor quality of the items, the recycling plants do not accept them for recycling purposes, and for that reason the plastic waste separated from the biowaste needs to be incinerated. At Western biogas LTD, transporting plastic waste elsewhere to be incinerated caused considerable expense since the plant was located far from the nearest incineration plant. Thus, at the biogas plants the handy packaging that on the shelf of a retail store once protected food from spoiling or made it convenient for consumers to take their waste to the recycling bin turns into inconvenient excess. The fluidity and heterogeneity of biowaste becomes apparent in situations where valuable biowaste contains a lot of material that is, in the end, not valuable for the biogas plants but rather disturbing and a cause of economic loss, and thus biowaste resists its turning into homogenous material that would be easily processable and become a source of value.

Caring for the reactors and slurry

Once biowaste has gone through the pretreatment process, it has been turned into more or less homogeneous slurry. At both of the plants studied, this slurry was then fed first into large containers located outside the main building where biowaste reception and pretreatment are housed and, from there, to the reactors. Optimising the gas production in the reactors as well as the composition of the fertilisers produced from the digestate required taking care of both the reactors and the indistinct, less-than-object mass that biowaste had become during the pretreatment process. This care implied 'collaborative and continuing attempts to attune knowledge and technologies' (Mol 2008, i) to keeping the process alive, smooth, and as efficient as possible. To optimise the conditions for the biogas production in the reactors and thus render biowaste into an asset, it was important to, for example, take special care of the temperature of the slurry that was fed into the reactors. The slurry needed to be warm enough, approximately 35–40 degrees, to create optimal conditions for the microbes. Thus, the process required constant monitoring, and materials that should not be mixed must be kept separate. Here, the practices focused, again, on keeping the mass fluid yet under control.

While biowaste is fluid matter, and the production of biogas at the plants blurs and even undoes rigid boundaries between value and problematic excess, it is not completely devoid of boundaries. On the contrary, the practices of dealing with the stuff also establish and try to maintain clear boundaries as to which materials should or should not be mixed together. The two plants where the ethnographic fieldwork took place treated both biowaste and sewage sludge. It was important for the plants to keep these raw materials separate, since farmers as customers are often unwilling to accept fertilisers which include human-based material. (Some foodstuff companies may refuse to buy cereals from farmers if they have used such fertilisers in the cultivation.) The sewage sludge and biowaste-based feedstock were kept apart throughout the whole production process: there were, for example, two entirely separate reception areas for the streams of these two materials, and the plants also had separate biogas reactors for them. Especially at Southern Biogas LTD, the workers

expressed their frustration over the limitations preventing these two streams of raw materials from mixing with each other:

> After lunch, I discussed my research and the utilisation of biowaste in biogas production with the plant manager and a plant worker. The plant worker said that biowaste is a good material, but it doesn't produce enough methane. He said that it would be best for the biogas production if they could add some shit from the sewage sludge to the biowaste that they use. However, the problem with this is that it is difficult to get rid of fertiliser that contains human-based material. (Field diary entry, Southern Biogas LTD, 26 May 2021)

The plant has to ensure their ability to get rid of the digestate to secure the continuation of the production process, even if this may lead to producing less methane and thus compromising value creation. The more methane the biogas contains, the more energy there is in it. However, because of the limitations related to sewage sludge based fertilisers, the potential gain that could result from mixing these two materials cannot be actualised. Here, separating biowaste-based slurry from sewage sludge acts as a technique of making difference (Law and Mol 2008) and thereby also enables the plant to keep biowaste as homogenous as possible. Through creating boundaries, the practice aims to make sure that the fluid biowaste would not slip from valuable matter to problematic excess.

In addition to the fact that the plants need to pay special attention to avoid mixing biowaste with sewage sludge, the process itself requires close monitoring. To ensure the steady operation of the reactors, the temperature of the slurry, the formation of foam in the reactors and the pH value of the slurry need to be carefully monitored. This monitoring is carried out, among other things, through taking samples and following different factors in reactors by using sensors. The workers emphasised that it is important to monitor the process for several reasons: for example, if some specific substance disrupts the chemical balance of the feed, this may cause foaming in the reactors. The foam may go to the pipe through which the gas is transported along the process, in the worst case breaking machinery. At both plants, there were several computer screens in the control room that displayed in real time how different parts of the process were running. The screens displayed templates about the process as a whole (e.g. reactors, tanks), and for example the level of foam in the reactors as well as the temperatures were expressed in numbers. However, at the Western Biogas LTD the level of the foam was also checked every day by looking inside the reactors through small windows placed on the upper part of the reactors. The employees carefully followed the functioning of the machinery and the smoothness of the process on their shifts, and the intensity of the feeding was adjusted based on this information. However, not even the closest monitoring can ever give the plants complete mastery over the process, because the slurry, the reactors, and the machinery can act in unexpected ways:

> The plant worker told me a story about how one time just before the end of his night shift one of the reactors had started to uncontrollably effervesce. He and his colleague ran downstairs to shut down the feeding, but some foam still ended up on the floor from one of the pipes. They washed the floor and thought that the situation was over, but then his colleague started to hear a buzzing sound from the pipe. The worker told me that the buzz tends to signal that there is once again some foam from the reactors in the pipe and, when this happens, the reactor vomits, as it were: just like people throw up if they eat something unsuitable, the reactor will start to uncontrollably foam if something causes imbalance in the process (Southern Biogas LTD, 25 May 2021)

In the situation described in the fieldnote, waste acted as unruly matter that foamed and spilled over in uncontrollable ways, ultimately making the reactor 'vomit' its contents. Feeding biowaste too intensively or feeding the wrong kind of biowaste to the reactor can result in foaming or have other kinds of unwanted consequences. For example, during the fieldwork at Southern Biogas LTD, the gas production in one of the reactors was almost completely down (the reactor was 'dead,' as the maintenance workers expressed it), partly resulting from testing a new batch of waste in the process. Thus, the production process cannot be intensified arbitrarily, nor is all available biowaste suitable for processing. Finding out whether a particular batch of waste is suitable for the plant is a precarious process, since there is not always enough information available on how

some substances may affect the production process. Thus, separating the valuable batches of waste from the valueless ones has to be carried out through joining forces with the machinery and the waste materials. Taking care of the process does not entail perfect control but involves sustained and careful tinkering with the machinery and the flows of materials (see also Heuts and Mol 2013, 125) and, again, creating boundaries between 'good' and 'bad' waste streams.

Selling the end-products and dealing with the overflows

After the microbes had broken down the slurry, and gas production in the reactors had reached its end, the digestate was run through pipes from the reactors to sanitation containers. In these containers, the temperature of the digestate was raised to 70 degrees Celsius to kill hazardous bacteria, enabling the safe use of the digestate as a fertiliser. After the sanitation process, fertilisers were then moved to storage pools (liquid fertiliser) or halls (dried fertiliser). The gas was stored, depending on the facilities of the plant, in separate gas storage or at the upper parts of the reactors. From this storage, the gas was moved forward to customers or to the different processes of the plant in which the gas is utilised to produce heat and electricity.

During the production process, biowaste undergoes a transformation from waste matter to assets: biogas and fertilisers. Turning these end-products into monetarily valuable assets proves, however, rather difficult. The difficulties are not only related to the fluidity of the matter itself and the machinery of the plant, but has also to do with underdeveloped markets, low electricity prices, and the costliness of investments. Based on our data, the difficulties of selling and distributing biogas do not result from the lack of demand for biogas. Rather, one of the main issues currently is that selling the energy does not create enough cashflow to justify costly infrastructure investments that more efficient gas distribution would often require. The CEO of Southern Biogas LTD highlighted that the investments to machinery and infrastructure are often really expensive relative to the turnover of the plants, and many other research participants pointed out the same issue. In addition to the problems caused by the costliness of investments to new infrastructures, the following example from Southern Biogas LTD further illustrates the mundane practical obstacles that biogas plants face when they try to distribute the gas:

> When we were about to start the bigger motor that converts gas to electricity, I asked the maintenance worker whether the plant also has another, similar motor, since I had seen a motor like this one earlier today in another part of the plant. He answered that the motor I saw is smaller than this one, and it is currently broken. He also said that it would cost something like 20,000 euros to fix it, and this is why it is currently under consideration whether it will be reasonable to fix it or not. The maintenance worker told that the smaller motor would be better than the bigger one that is still working, since it consumes less gas and thus it could be kept running almost all the time, even if the gas storage would not be completely full. The bigger motor can be started and kept running only if there is enough gas in the storage, and the prevailing demand for electricity also has to be taken into consideration when starting it. (Southern Biogas LTD, 27 May 2021)

The employees, plant managers, and CEOs have to take several factors into account when they consider whether it is reasonable and cost-effective to, for example, fix or start a motor or not, and thereby they also come to value biogas differently depending on the situation. Sometimes it was more reasonable to even get rid of some of the gas than start the motor. Torching was also used in cases when the gas storage was too full. As having an overfull storage could lead to environmentally hazardous methane leaking out, occasionally the plants burn excess gas in a torch. In situations like these, biogas becomes nothing but an excess that needs to be got rid of, and the valuation practices themselves end up producing new kinds of waste (see also Holmberg and Ideland 2021; Greeson, Laser, and Pyyhtinen 2020) that has to be dealt with.

When discussing the use of biogas, the research participants often referred to a specific policy issue: the current aim for the electrification of passenger car traffic in the EU and Finland disrupts the assetisation of traffic biogas, and car manufacturers have cut the production of biogas cars. However, they also often mentioned that legislative action in Finland obliging transport fuel

distributors to annually distribute a certain amount of fuels produced from renewable raw materials, is a good thing for traffic biogas producers. This illustrates the nature of biowaste-based biogas as an asset that is more-than-object: its assetisation is thoroughly entangled with national and EU energy policies.

If it is not easy and straightforward to make a profit from biogas, it is no less difficult to generate value out of the biofertiliser produced from the digestate. According to our participants, currently there is demand for the fertilisers in agriculture and gardening, but the problem is that farmers, as one the largest group of potential users and purchasers, are often unwilling to pay for the fertiliser. According to our informants, one reason for this is that the farmers may already have manure in their disposal that they can spread to the fields without any additional costs. They may also for example consider the use of fertilisers made from non-renewable resources more convenient and easy. Thus, in the current situation, the fertilisers were sometimes considered as a troublesome material that the plants just need to somehow move forward:

> I went to talk to the CEO of the plant and asked him whether he considers the production of fertilisers or gas as more important for their business. He said that the fertiliser is a 'necessary evil' for them and they just try to somehow dispose of it. He said that at times it is hard to get rid of the fertilisers, and it is also difficult to obtain money from them. He said that they get some money from the organic fertiliser, but the other fertilisers they have to give away for free (Western Biogas LTD 4 June 2021)

While possible excess biogas can be burned in a torch and thus ridded quite effortlessly if needed, fertilisers need to be stored, and the storage spaces, of course, are not infinite. To prevent the fertilisers from piling up and filling up storage space, the plants have to find ways to set the matter in motion: in some cases, they give it away for free, and occasionally they even pay for the freighting. Even though biogas producers often stress the ecological value of the fertiliser that they produce (it could substitute currently used fertilisers made from non-renewable raw materials), here the valuation of the fertiliser nevertheless means that the plant tries to get rid of it in the least costly way (see also Valve, Lazarevic, and Humalisto 2021). Thus, on the one hand, in turning biowaste into biogas and especially into biofertiliser, the production of biogas does not currently succeed in transforming that matter into a valuable asset, but its unruliness and excessness remain a constant matter of concern in the process. The wasteness of the material does not wear off just like that.

Yet, on the other hand, the excess still 'contains rich potential for reinterpretation and reuse' (Edensor 2005, 311), and several problems that Finnish biogas producers currently face are probably not permanent. In fact, many informants had faith in the prospect that selling the energy would generate profit in the future, one way or another. However, while the term 'reinterpretation' easily renders the materials themselves as passive and inert, biofertiliser or biogas do not just passively wait out there to be utilised. As we have shown in our analysis, they are made to be and manipulated in concrete practices, and they also themselves delimit and shape these practices. What is more, as more-than-objects, they have a capacity to provoke action (see also Hawkins 2006), such as the current aim in the biogas sector to promote policy programmes to support the assetisation of fertilisers and biogas shows.

Conclusion

In this article we have analysed, through an ethnography of the everyday operations of Finnish biogas plants, the practices of turning biowaste into an asset, and how waste itself affects the possibilities of valuing it. Following the leaky practices in which value and waste are produced at the biogas plants comprises the main empirical contribution of the article. Based on our research, the question as to whether biowaste can be successfully translated into an asset in the context of the CE cannot be answered by a simple yes or no. Instead, our analysis has shown that there are several grades and shades of successful (and less successful) action and management of waste (see also de Laet and Mol 2000).

Our analysis suggests that, in contrast to the system-level CE discourse that cherishes the idea of all-out elimination of waste through turning it into a resource, it is important to acknowledge how the valorisation of waste cannot be carried out simply by means of more efficient mastery of waste matter. Making waste circulate requires concrete hands-on work that does not guarantee perfect control over waste matter but entails careful alignment with materials that do not always act as wished. The research examining such hands-on work has so far mainly (but not exclusively, see e.g. Holmberg and Ideland 2021) focused on how consumers, for example, save food from ending up as waste (Lehtokunnas et al. 2022; Mattila et al. 2019). By contrast, one of the aims of this article has been to examine how the CE is enacted on the production side in concrete and messy everyday practices. Integrating these two into one holistic view remains a task for future research.

Our emphasis on the fluidity of biowaste and the products produced from it – biogas and biofertilisers – does not merely insist on leakages, spills, and interruptions as integral to the normal operations of the biogas plants that we studied. The point that waste management is not perfectly circular, and accomplishing circularity requires concrete 'make-up' work, has already been made by previous research (Holmberg and Ideland 2021). By approaching biowaste as *fluid matter*, we wish to contribute to the reorientation in waste studies (and material studies alike) from clear-cut objects to approaching waste as fluid, mutable, and flowing (see also Alexander and Sanchez 2018; Crang et al. 2013; Lepawsky and Billah 2011; Liboiron 2016). As long as the focus is on crystallised objects, it is difficult if not altogether impossible to grasp the constitution of material things and follow the changes that materials go through.

At the biogas plants that we studied, the processuality and fluidity of biowaste was manifest throughout the entire process. Before the biowaste was fed into the reactors, it first had to be pretreated and turned into an anonymous, less-than-object mass. Interestingly, though, the plants seldom succeeded in completely mastering the composition of the mass, because contaminants such as small pieces of plastic and sand easily remained in the slurry. In order to optimise gas production inside the reactors as well as the composition of fertilisers, the waste matter and the technology had to be taken care of through monitoring and balancing the volatile process. During the production process of biogas, biowaste itself as well as the microbes in the reactors strongly affected the ways in which waste could be valued, since a wrong kind of attunement with them could have caused foaming or even completely killed the process.

What is more, while biowaste itself lacked clear boundaries due to its fluidity, it was nonetheless essential for the plants to establish several boundaries in order to be able to value it successfully. For example, sewage sludge had to be kept apart from biowaste-based slurry, and the plants needed to separate problematic batches of waste from the valuable ones. Finally, when the microbes in the reactors had chewed up the waste, biowaste was turned into new assets: biogas and fertiliser. However, as our analysis showed, the boundaries between valuable assets and problematic excess are not fixed, but themselves rather fluid. Ultimately, in the operations of the biogas plants, fluidity thus not only had to do with the qualities of biowaste itself as it is transformed into a slurry in and through the treatment process, but it also extended to the ambiguous, precarious, and shifting line between waste and value/price (as the products of digestion may not always create a revenue stream or reach the market to be sold). For example, on some occasions the fertilisers turned out to be problematic excess that the plants just had to get rid of, and the problems with the distribution of gas sometimes forced the plants to burn excess gas in a torch. However, this is not to say that the plants could not succeed in creating monetary value out of their end products in the future. The current energy crisis in Europe resulting from the Russian invasion of Ukraine has already changed the situation of the Finnish biogas sector. For example, according to the Finnish Biocycle and Biogas Association (Virolainen-Hynnä 25 Aug 2022), interest in both biogas and biofertilisers has grown after the prices of natural gas and mineral fertilisers have gone up. In this sense, the value of biowaste, biogas, and fertilisers is not only fluid but also 'virtual' (Deleuze 1966, 1968; Lehtonen and Pyyhtinen 2020) – it may actualise in some other situation, through different processes in social and economic organisation.

For us, the fact that the workers at the biogas plants tinkered with an array of precarious, vague materials instead of solid objects also meant that their practices enacted biowaste at once both as less-than-object and more-than-object. It was enacted as 'less' in the sense that its nature as a clear-cut object was stripped off, and it was transformed into an anonymous, homogenous mass to enable its valuation. At the same time, valuing biowaste as an asset also called for producing and manipulating it as more-than-object by creating new relational entanglements for it. Generating value at the plants entailed practices of assembling, that is, classifying, grouping, sorting, and creating new relations. In result, biowaste became part of another regime of value and novel configurations, which involved contracts and also simultaneous coordination between several different sectors, such as the energy industry, waste management infrastructure, and agriculture. At the same time, the integration of biowaste into this value regime also required that it was *disassembled* from its previous connections to the processes of consumption and production that had produced it (Greeson, Laser, and Pyyhtinen 2020). As a whole, by breaking things open and by showing the complex societal, technological, and economic relations that different materials are entangled with, we believe that this kind of approach, which emphasises the fluidity and volatility of matter and the relational settings of which it is part, can also help scholars tap into the vulnerabilities, complexities, and sustainability challenges of not only waste management and food systems but all attempts at establishing order.

Notes

1. With biowaste we mean biodegradable food and kitchen waste. This may include food waste, inedible parts of food (e.g. peels and bones), and side streams from the food industry.

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PUBLICATION IV

The circular economy futures in the making: Transformativity and object ontologies in food waste practices in Finnish households, supermarkets and biogas plants

Taru Lehtokunnas

Manuscript submitted for publication.