The Commoditization of Food Waste: A Case Study in the Province of Québec

by

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THESIS ABSTRACT

Food waste occurs across various levels of the food system, from the stages of production to consumption. Prevention of this waste can help mitigate greenhouse gas emissions and contribute to improving food security. Private actors in Québec have taken an increased interest in wasted food, seeing an opportunity to turn it into profitable products. So-called 'upcycled foods', which turn food waste into edible new food products, are an example of one such initiative. While upcycled foods are gaining more social acceptability alongside interest in sustainable diets, this sector of the province's economy remains nascent and has yet to garner much scholarly attention. In this thesis, I investigated the opportunities and challenges facing entrepreneurs in this sector. To do so, I conducted semi-structured interviews with representatives from six upcycled food companies in the province to ask about their commodity chains and relationships with different actors. My findings show that the most common challenges were those related to social acceptability at initial stages of conception, supply consistency and production volume. The greatest potential for growth appeared to be through partnerships and collaboration with other private and non-profit actors. Most importantly, the biggest influence of interviewed companies on environmental sustainability rested in their ability to redefine waste as a profitable locus for agri-food innovation. This established profitability, in turn, fosters waste consciousness of industry stakeholders, leading to greater engagement and transparency in waste production and mitigation. While my exploratory study is a crucial step in drawing a preliminary profile of this emerging industry in Québec, future research should examine life cycle environmental impacts and social equity dimensions in order to more fully understand the overall sustainability implications of upcycled foods.

CHAPTER 1: INTRODUCTION

In 2019, 3.1 million tonnes of food were discarded in landfills in the Province of Québec, Canada. Of these, over a third were still edible (Recyc-Québec, 2022), meaning that if this food waste could be prevented, it could potentially be redistributed across the province's foodbank network and provide nourishment for people. Such inefficiencies and waste are caused by a variety of factors, including inaccurate market forecasts or business decisions, leading to a poor coordination in supply and demand among local producers (Bhatt et al., 2018). These factors are further exacerbated by wasteful processing and retailing practices, accounting for over 50% of total food waste Recyc-Québec, 2022) This ensuing waste is detrimental to the environment, as the decomposition of food in landfills is an important source of greenhouse gas emissions and contributes to substantial waste of energy as well as other resources in food production (Crippa et al., 2021). For instance, nearly 24% of water used in global food production is involved in producing wasted food, translating into systemic energy inefficiencies (Kummu et al., 2012). Additional concerns have been raised regarding food access and nutrition, as the mitigation and redistribution of food waste could potentially aid Québec's food insecure, which currently represents about ten percent of the province's population (Polsky & Guarriguet, 2022). However, as most countries of the Global North such as Canada lack coherent food policies (Riches, 2022; Tarasuk et al., 2014), top-down governance initiatives regulating waste in global and local food chains have typically been inadequate at addressing problems such as food waste.

In response to the pervasive issue of food waste, the private sector has taken an increased interest in forming partnerships with grocers and agricultural producers to commoditize their waste (Tchonkouang et al., 2023). Among such valorization efforts lies the commercialization of 'upcycled' foods. The process of food upcycling involves the transformation of otherwise discarded foods into new edible products, including processing or preparation that adds value (Spratt et al., 2021). In a Global North context, the growing social acceptability of re-using foods that would traditionally be wasted is increasingly coinciding with the popularity of the alternative food movement (Bhatt et al., 2018). Indeed, much like their organic counterparts, upcycled foods are often marketed as a healthier and more environmentally sound option compared to generic brands (Milfont & Markowitz, 2016).

In Québec specifically, the Legault government's recent *Stratégie gouvernementale de développement durable 2023-2028* seeks to expand such circular economy initiatives through the

creation of various funds. While the upcycled food market is growing, the general movement has been criticized by some scholars, both in its ability to divert food waste and produce affordable and accessible foods (Boccia & Sarno, 2019; Calderon-Monge et al., 2021; Lerro et al., 2019; Moshtaghian et al., 2017; Thorsen et al., 2024). Although it may present a creative way to transform food waste, upcycling food waste may only offer a temporary fix to a systemic issue, as it does not target reduction of waste at the source and inefficient management practices along the supply chain (Spratt et al., 2021). Additionally, upcycled foods tap into a niche market, producing rather exclusive and possibly more expensive commodities. These products are thus more likely to be consumed by a younger, wealthier, and more educated clientele concerned about the environmental impacts of their diets (Moshtaghian et al., 2021).

1.1: Research aim & questions

The commercialization of upcycled foods in Québec is gaining momentum. This is evident with the influence of healthy eating and sustainable living conventions, such as the *Festival Zéro Déchet*[1], that are now held annually in the province. Indeed, these conventions play a critical role in promoting alternative and sustainable foods to the mainstream public, allowing for their wider acceptability. In the city of Montréal specifically, these products have become increasingly accessible through popular food basket delivery programs such as Lufa Farms and Marché SecondLife. While this industry represents a growing portion of the province's alternative foods market, its operational characteristics and partnerships with large and small agri-business stakeholders remain understudied. In this thesis, I therefore employ a mixed-methods case study approach to characterize the commodity chains of six Québec-based upcycled food companies. Using social network analysis, I further identify key partnerships facilitating the development of the province's upcycled foods sector. To guide my analysis, I use Aschemann-Witzel et al.'s (2023) categorization of upcycled foods, dividing the interviewed companies into two groups, namely 'novel' and 'alternative' use companies. 'Alternative' use upcycled food companies use unsold produce as their input material, whereas 'novel' use companies transform inedible agri-food industry byproducts into new edible products.

My overarching research questions are:

[1] See https://www.aqzd.ca/nos-membres/.

1. *From supply to manufacturing, what are the main production characteristics of these 'alternative' and 'novel' use upcycled food companies, and in what ways do their commodity chains compare to or differ from one another?*
2. *What types of partnerships – whether for- or non-profit – underly the commodity chains of each company, including among the different actors involved in the processing of food waste or facilitating the company's mission?*
3. *What are the main challenges and successes facing companies engaging with circular economy ideals related to upcycling food waste in* Québec*?*

Based on my findings, 'novel' use upcycled food companies appear to operate at a later stage of the food chain and rely on greater technological sophistication, as they transform agri-food byproducts. 'Alternative' use companies on the other hand, salvage agricultural surpluses still fit for human consumption, redefining traditional definitions of waste. The biggest operational distinction between both categories thus lies in their supply source. The interviewed food upcycling companies' most common self-reported challenges are social acceptability, supply inconsistencies, and production volumes. To counter these difficulties, the use of certifications from the Upcycled Foods Association and the 'Aliments du Québec' logo are useful in fostering consumer trust, while preservation methods are widely used to ensure a steady stupply. Collaboration is also key in this industry, as smaller companies rely on the knowledge and technology of larger ones to increase output capacity. As this is a form of mission-driven entrepreneurship, upcycling activities are often facilitated by non-profit organizations, while still fostering private partnerships to ensure profitability. Indeed, the collaborative nature of this sector, coupled with its profitability and expanding market are identified as the sector's primary opportunities. Finally, the trust built with large agri-food industry stakeholders could lead to greater transparency in the amount of waste they produce, promising a potential avenue for long-term sustainable change.

1.2: Significance of research

While there is a substantial body of literature on the conversion of food waste into animal feeds (Malamakis et al., 2023; Quintero-Herrera et al., 2023; de Paula et al., 2023), biofuels (Dhalsamant et al., 2023; Katakojwala et al., 2021; Aierzhati et al., 2019), and bioplastics (Ferreira et al., 2023; Petraru & Amariei, 2023), food waste valorization techniques – necessary

for transforming waste into a marketable, value-added product – destined for human consumption are a relatively new and understudied phenomenon. In Québec specifically, the growing commercialization of upcycled foods has, to my knowledge, not yet received critical scholarly attention despite its potential benefits to the environment and society. In this study, I therefore seek to identify and present some of the different types of actors, transformation processes, and experiences involved in the production of upcycled foods based on a case study of six Québec-based companies. In doing so, my research could potentially inform future developments by government bodies or companies wishing to engage with circular economy principles or corporate social responsibility around food waste, both in the province and in other Global North contexts.

1.3: Thesis structure

In Chapter 2, I explain the conceptual framework that guides my thesis. To assess each company's commodity chain, I draw on two interrelated concepts: *upcycled foods* and *sustainable diet*. I then introduce the idea of commodity chains and explain their relevance to my analysis. In the following chapter, I contextualize this study in the province of Québec's unique political landscape, situating current sustainable financing efforts in the government's *Stratégie gouvernementale de développement durable 2023-2028.* In Chapter 4, I present my research methodology, including my overarching study design, data collection, and analysis process, while also addressing potential positionality concerns. My results are then presented in two consecutive chapters. In Chapter 5, I use commodity chains to each company's production and social processes, attempting to characterize their operations. In Chapter 6, I identify the challenges and opportunities of entrepreneurs working in the production of upcycled foods, drawing on approaches from social network analysis to describe how relationships among different actors may represent a coping strategy. Finally, I conclude my thesis in Chapter 7 by providing a synthesis of my findings and some possible future avenues for research.

CHAPTER 2: CONCEPTUAL FRAMEWORK

To understand the emergence of upcycled foods in the province of Québec, I employ a conceptual framework drawing on three interrelated concepts: upcycled foods, sustainable diets, and commodity chains. I use the concept of upcycled foods to introduce the economic and entrepreneurial ways in which the private sector may help to fill some of the socio-ecological gaps around food waste. Using the concept of sustainable diets, I explore how consumer behaviour shapes the demand for upcycled foods. Lastly, I define the concept of the commodity chain, explaining how this method will be useful in understanding the various partnerships and systems characterizing this nascent sector of the agri-food economy.

2.1: Upcycled foods

The Upcycled Food Association defines upcycled foods as value-added products, "made from ingredients that would otherwise have ended up in a food waste destination" (*About Upcycled Food*, n.d.). Under the upcycled food lens, 'food waste' is reconceptualized from a market externality to a profitable sustainable venture (Cohen & Winn, 2007; Thorsen et al., 2024). Indeed, this concept was first introduced by food engineering scholars as a way to counter food losses across the supply chain (Bhatt et al., 2018; Roy et al., 2023; Sharma et al., 2024; Tchonkouang et al., 2023). While current food waste valorization efforts rely mostly on the methods of combustion, pyrolysis, and gasification for the productions of biofuels and energy (Aierzhati et al., 2019; Dhalsamant et al., 2023; Katakojwala et al., 2021; Sharma et al., 2024)), upcycled foods emerge from various separation and chemical processes (Sharma et al., 2024). For instance, prevalent valorization methods include mechanical separation technologies such as juicers, lyophilization equipment to freeze-dry produce and meats, and the fermentation of vegetables to extend their shelf life (Sharma et al., 2023). Definitions of 'waste' also differ from one company type to another. For instance, Aschemann-Witzel et al. (2023) divide upcycled foods into two main use categories, namely 'alternative' and 'novel' uses. The former distinction is used to describe the diversion of edible products from landfills. This could include, for instance, the valorization of 'ugly' produce that are not sold on the market due to strict standardization practices (Mookerjee et al., 2021). On the other hand, 'novel use' upcycled foods are more innovative in that they transform byproducts that are commonly regarded as inedible into new foods. An example of such products includes the creation of fortified flours made of soy

pulp, a byproduct of soymilk production (Spratt et al., 2021). Thus, while 'novel' use upcycled food companies do use industry food waste as an input material, 'alternative' use ones avoid food waste by using edible market surpluses. These two distinctions are useful for my research, as they are the main method of differentiation I employ when constructing the interviewed upcycled food companies' commodity chains.

For my research, I base my analysis on Thorsen et al.'s (2024) measures of upcycled foods sustainability. Indeed, I employ the authors' three-dimensional sustainability categories, touching on upcycled foods' environmental friendliness, economic viability, and social equity. More specifically, stakeholders in the upcycled food movement argue that this technology may reduce greenhouse gas emissions and other environmental externalities involved in the food production process, both through the diversion of food and energy waste (Spratt et al., 2021; Thorsen et al., 2024). As above mentioned, this commoditization of waste is also seen as an economically viable alternative, as it transforms a market inefficiency into profit, a consumer-based approach particularly well suited for our capitalist economy (*About Upcycled Food*, n.d.; Cohen & Winn, 2007; Thorsen et al., 2024). Finally, while still understudied, its effects on social equity are generally assumed to be positive. Such measures of social equity involve socio-economic benefits like job creation, better public health through carbon reduction, and food security, which are considered achievable through the wider implementation of food upcycling initiatives (Spratt et al., 2021; Thorsen et al., 2024). Next, I focus on defining the economic concepts from which upcycled foods emerge.

2.1.1: Circular agri-food economy

'Circular economy' can be defined as "an economic system that replaces the 'end-to-life' concept with reducing, alternatively reusing, recycling, and recovering materials in production/distribution and consumption processes" (Kirchherr et al., 2017, p. 229). This alternative economic system opposes current extractive and linear modes of production that uphold assumptions of infinite growth, for the promotion of restorative and ecological ones (Hamam et al., 2021; Jurgilevich et al., 2016). This framework is especially useful in studying the agro-food sector, as its embeddedness in social and environmental systems prompts the investigation of innovative and sustainable economic approaches to food production (Hamam et al., 2021; Jurgilevich et al., 2016). More specifically, circularity in the agri-food economy can

include the support of local agricultural practices that produce less waste, promoting better supply chain management, and policies such as taxes and economic incentives encouraging stakeholders to reduce food waste (Hamam et al., 2021; Jurgilevich et al., 2016). However, such initiatives require cooperation across numerous actors and scales.

Indeed, Kirchherr et al. (2017) note that circularity is multiscalar, operating at various levels of an economic and political system. The implementation of economic circularity includes, for instance, changes at the micro level within companies, at the meso level within industrial parks or corporations, or at the macro level within administrative units such as cities, regions, nations, and globalized trading systems. Thus, to account for potential externalities at all levels, Hamam et al. (2021) and Jurgilevich et al. (2016) argue that it is necessary to adopt a holistic approach promoting the governance of food waste across all scales to further explore this alternative system. Another way in which circularity can be understood in the agri-food industry is through the idea of 'closing the loop' (Di Fraia et al., 2024; Govindan et al., 2015). 'Closing the loop' refers to the complete reutilization of wasted resources. The idea of food waste valorization thus fits neatly within the circular economy framework, as it seeks to reuse and recycle the entirety of otherwise discarded foods, effectively closing the production system's loop (Di Fraia et al., 2024). I thus use this concept to understand how interviewed stakeholders engage with economic circularity ideals across their production chains.

2.1.2: Sustainable entrepreneurship

Cohen and Winn (2007, p.35) define sustainable entrepreneurship as "the examination of how opportunities to bring into existence future goods and services are discovered, created, and exploited, […] and with what economic, psychological, social, and environmental consequences". They argue that this form of venturing creates investment opportunities from the market's environmental inefficiencies. Furthermore, they highlight four scalable market imperfections related to firms, negative externalities, flawed pricing mechanisms, and imperfectly distributed information (Cohen & Winn, 2007). The concept of negative externalities is especially useful in better understanding upcycled food businesses operating within a circular economy framework. Indeed, minimizing or nullifying earlier negative externalities – here, food waste – "generates opportunities for new ventures" (Cohen & Winn, 2007, p. 40) while promoting environmental sustainability.

As is the case for social entrepreneurship, a type of venture concerned with equity and welfare, sustainable entrepreneurship is often categorized as mission-driven (Dixon & Clifford, 2007). However, Binder and Belz (2015) contest this claim, arguing that, for the field's entrepreneurs, profit generation is seen as equally important as their sustainability mission. Thus, sustainable entrepreneurship can be characterized as both environmentally responsible and profitable (Binder & Belz, 2015). The relationship between sustainability and profit can also be understood as a self-reinforcing one. For instance, scholars studying food purchasing behaviour note that companies using ecolabels and marketing their food products as healthy, traceable, fair-trade, and sustainable, tend to foster greater consumer trust (Boccia & Sarno, 2019; Calderon-Monge et al., 2017; Lerro et al., 2018; Lerro et al., 2019). In turn, a transparent and trustworthy business can charge a price premium for its products, as consumers' willingness to pay increases. This phenomenon supports the means-end theory, wherein consumers are willing to pay more for products that enhance their self-esteem and provide them with "the opportunity to be a part of something good being done" (Narayanan & Singh, 2023, p. 2227). As part of my conceptual framework, this concept will thus help me understand how waste is defined as a business opportunity by the studied businesses, evidently inspiring the type of entrepreneurship and advocacy they engage in.

2.1.3: Critiques

Because of their novelty, upcycled foods are often critiqued for their unaffordability. Indeed, their manufacturing can involve lengthy and pricy research and development processes, consequently marketing them at a price premium (Thorsen et al., 2024). Such products may thus be quite exclusive in nature, appealing to consumers of wealthier socio-economic backgrounds who have the privilege of using their purchasing power to consume in concordance with their ethical and environmental beliefs (Boccia & Sarno, 2019; Calderon-Monge et al., 2021; Lerro et al., 2019; Moshtaghian et al., 2017). Additionally, there are empirical difficulties in measuring the average consumer's social acceptance and willingness to pay for such foods, as they are part of a new movement with which the public has yet to fully familiarize itself (Bhatt et al., 2018). Increased public awareness of food waste issues and greater cost transparency of upcycled foods are thus crucial in ensuring the wider implementation of such initiatives (Bhatt et al., 2018; Cela et al., 2024; Peschel & Aschemann-Witzel, 2020). Common critiques are also wary of the industry's role in preventing waste. Binder and Belz (2015) argue that sustainable enterprises end

up filling important gaps stemming from systemic inefficiencies, subsequently deflecting blame from governments, and contributing to their environmental inaction.

2.2: Sustainable diets

Meybeck and Gitz (2017, p. 3) define sustainable diets as those that have "low environmental impacts [and] contribute to food and nutrition security and to healthy life for present and future generations". Environmental impacts are commonly calculated using life cycle assessment tools, meant to estimate a food product's total energy use and emissions through the stages of "production, transportation, packaging, and consumption" (Tanner et al., 2004, p. 99; Jones et al., 2016). Low-emission diets are therefore largely plant-based, local, seasonal, organic, and low-waste (Brunin et al., 2022; Donati et al., 2016; Tanner et al., 2004). Because upcycled foods seek to divert food waste from landfills and avoid the harmful emissions resulting from anaerobic decomposition, they thus fit logically within a sustainable diet framework (Crippa et al., 2021; Spratt et al., 2021; Thorsen et al., 2024).

While a diet's environmental sustainability assessment is relatively straightforward, the reasons for which individuals adhere to such eating principles are more complex. However, some key motives of health and environmental morality are commonly identified (Marty et al., 2022; Meybeck & Gitz, 2017). Indeed, individuals concerned with their health tend to indirectly adopt a more sustainable diet, as they purchase less meat and more whole, organic, and local foods (Marty et al., 2022). On the other hand, individuals may adopt such a diet for 'outwardly' reasons, extending visions of nutritional sustainability to ones that includes human and animal welfare (Chuck et al., 2016; Reisch et al., 2017). In both cases, however, eating sustainably is viewed as a political act and identity marker reinforced by sociodemographic traits, values, and community (Chuck et al., 2016) In the following sub-sections, I further relate these ideas of sustainability to the concepts of eco-consumerism and 'clean eating', anchoring them in the broader sustainable diet framework.

2.2.1: Eco-consumerism

Eco-consumerism, or 'green' consumerism, can be understood as "a list of [consumption] behaviors that are undertaken with the intention of promoting positive environmental effects" (Sachdeva et al., 2015, p.60). As a field of research, it is especially useful in studying the various

factors that promote pro-environmental purchasing behaviors (Kostadinova, 2016). Di Giulio et al. (2014) and Vermeir et al. (2020) argue that such behaviors are based on two complementary impact and intent-oriented approaches. An impact-oriented approach focuses on the consumer's awareness of their purchases' environmental consequences, whereas an intent-oriented approach centers on their desire to adopt sustainable consumption practices. Thus, eco-consumerism emerges at the intersection of both approaches, when consumers are both well-informed and empowered to consume sustainably (Di Giulio et al., 2014; Vermeir et al., 2020).

However, a multitude of variables may predict a consumer's willingness to buy sustainably. Sachdeva et al. (2015) argue that this intention is influenced by endogenous, exogenous, and structural factors. Endogenous factors are characterized as individual preponderations to consume sustainably. This includes, for instance, environmental values, but also sociodemographic markers such as gender, age, education level, and economic status (Kostadinova, 2016; Mazhar & Zilahy, 2023; Milfont & Markowitz, 2016; Peattie, 2010). Most notably, Milfont and Markowitz (2016) note that consumers who are female, younger, more educated, and wealthier tend to adopt more pro-environmental purchasing behaviors. Exogenous factors on the other hand, relate to the ways in which interpersonal relations and cultural contexts may foster or impede such habits (Sachdeva et al., 2015). Finally, structural factors are concerned with how institutions and markets influence individual purchases. This includes, but is not limited to, the ways in which national affluence, market regulations, international trade, marketing, and product availability shape this form of consumption (Milfont & Markowitz, 2016; Peattie, 2010). Other variables pertaining to the built environment and transport infrastructure are believed to play a crucial role in facilitating sustainable purchases (Kostadinova, 2016; Milfont & Markowitz, 2016; Tanner et al., 2004). Considering such variables is thus essential for the critical analysis of my results, as they help situate my research's findings from the consumer's perspective and demand for upcycled foods.

2.2.2: Clean eating

Walsh and Baker (2020, p. 570) define clean eating as "a dietary practice adhering to consuming 'healthy' foods deemed to be 'pure'". Self-reported definitions associate clean eating with whole foods, unprocessed, non-GMO, and organic components (Ambwani et al., 2020; Brunin et al., 2022; Marty et al., 2022). This movement has gained momentum on social media platforms such as Instagram, forming online communities based on responsible food consumption (Ambwani et

al., 2020; Johnston & Goodman, 2015). Johnston and Goodman (2015) describe the important role that food celebrities – or 'influencers' – play in promoting clean diets. Through their online legitimacy, such celebrities dictate which foods are 'right' and healthful, consequently pushing their followers to adopt a morally grounded diet.

Guthman (2009) attributes this healthy eating trend to the rise in the neo-liberal biopolitics of self care, wherein dieters experience an increased feeling of worthiness through their abilities to regulate and control the quantities and types of foods they consume. Walsh and Baker (2020) explain that this trend has moved beyond a simple lifestyle change and that it is now part of the dieter's identity. Indeed, clean eaters have formed an extensive online community, fostered by a shared sense of food morality. As previously discussed, consumers who focus on the health aspects of food tend to eat more sustainably (Chuck et al., 2016; Brunin et al., 2022; Marty et al., 2022; Tobler et al., 2011). This attitude is thus essential in understanding clean eaters' willingness to consume upcycled foods. Indeed, Augustin et al. (2020) argue that the upcycling of fruits and vegetables could promote a healthy diet by increasing their consumption in increasingly novel ways, a view shared by the Upcyled Food Association (n.d), who emphasizes the nutritional quality of its products. Upcycled foods can thus be situated in the context of healthy and trendy diets, a crucial point in understanding their demand and social acceptability.

2.2.3: Critiques

A prominent critique of sustainable food consumption rests in its harmful emphasis on individual action to reduce greenhouse gas emissions (Evans et al., 2017; Meisch, 2013). Indeed, by turning to a market-based solution, one implicitly agrees that consumers should solve inefficient food systems caused *by* overconsumption (Evans et al., 2017; Meisch, 2013). Not only is individual impact potentially overestimated in this scenario, but it does not consider the various socio-economic factors that may hinder an individual's potential to consume sustainable products (Evans et al., 2017). Additionally, targeting individual consumption practices deflects the blame away from governments and industries that fuel these linear and extractive modes of production and overconsumption (Evans, 2011; Myers et al., 1997; Sekulova, 2013).

2.3: Commodity chains and the agri-food sector

Hopkins and Wallerstein (1986, p. 159) define commodity chains as "a network of labor and production processes whose end result is a finished commodity". Put differently, commodity chains highlight which relationships and activities are necessary to create a manufactured good and sell it on the market (Bair, 2008; Dougherty, 2008). Such relationships can be situated within world systems theory, as they point to the ways in which local consumption and production practices are embedded in the global economy (Bair, 2008). When used as visual tools, they can be drawn using boxes or nodes to form a network. Each successive box or node characterizes a distinct actor, specifying a new step or organizational input in the production and distribution processes. The resulting network thus constitutes the studied commodity chain (Gereffi et al., 1994).

In addition to representing the above-mentioned input-output structure, Sverrisson (2004) adds that these chains operate in a set space or territory, and that they require a governance structure to oversee their various capital and commodity flows. Indeed, Gereffi et al. (1994) argue that these globalized networks are always situationally specific and locally integrated. Indeed, food chains – of particular interest to my study – are always localized as they are "mediated by regional and local relationships" (Maye & Ilbery, 2008). This assumption is useful, as it provides a basis for me to highlight how local actors form partnerships to respond to inefficiencies in the global food system. Further relating this to Sverrisson's (2004) claim on commodity chain governance, organizational structures are characterized as either buyer or producer-driven (Bair, 2008; Gereffi, 1994). Buyer-driven commodity chains emerge as a result of decentralized production networks, whereas producer-driven commodity chains are directly controlled by large corporations (Bair, 2008; Gereffi, 1994). Food chains can thus be situated within the first framework, as they pass through many intermediaries with varying degrees of connection before being sold on the market. However, Gibbon (2001) contrasts this claim, arguing that, because of the recent politicization and liberalization of food systems, consumers play an increasing role in shaping buyer demand, consequently producing a new type of user-driven chain. This argument ties to my previous conceptual foundations around sustainable diets, and eco-consumerism more specifically, as these concepts are helpful in studying how consumer demand helps shape the upcycled food commodity chain.

2.4: Conceptual framework conclusion

The three concepts outlined in the previous chapter provide a comprehensive conceptual framework to guide my analysis. While concepts such as upcycled foods and sustainable consumption have been criticized, I will use these commentaries to offer a more nuanced discussion of my results, looking at issues of social equity in the eco-consumerism movement. Concepts around sustainable and politicized diets will be useful in understanding the demand and market for such products. Finally, I will use the above-described 'alternative' and 'novel' use upcycled foods to characterize the interviewed stakeholders' commodity chains, highlighting the various technologies, processes, and relationships necessary to sell their products on the market.

CHAPTER 3: STUDY AREA BACKGROUND & CONTEXT

I briefly introduce the province of Quebec and the steps being taken to address circular economy principles. This builds on my conceptual framework by situating how the concept of the circular food economy is being formulated into government policy around sustainability, as well as in the nascent industry around upcycling more specifically. However, I illustrate how current policies remain inadequate in promoting such initiatives, paving the way for greater agri-food industry involvement in the form of sustainable entrepreneurship to counter the issue of food waste.

Since its election in 2018, the *Coalition Avenir Québec* (CAQ) government, led by Premiere François Legault, has attempted to align with its electorate's increased environmental awareness. During the 2021 federal elections, 87% of Quebecers surveyed using the Vote Compass, a polling method employed to study voting intentions, responded that the government should increase its efforts to reduce greenhouse gas emissions (Meloche-Holubowski, 2021). This opinion is shared among generations, as evidenced by the province's various 2019 youth led FridaysForFuture strikes. As a result, the CAQ, whose political agenda rests largely on the complex issues of Québec's identity politics and the preservation of the French language, has adopted a new form of modern nationalism to appeal to a more diverse electorate (Boily, 2018). Montigny and Margineanu-Plante (2022) argue that, through its six years in power, the government has shifted its governance approach from one rooted in linguistic nationalism to a more substantial form of provincial autonomy in its judicial and economic spheres. This increased economic autonomy, in turn, translates into greater control of provincial environmental governance and ecological fiscal policy (Gajevic Sayegh et al., 2022). Such examples include Québec's linkage with California's cap-and-trade carbon market and the province's recent membership to the Beyond Oil and Gas Coalition (BOGA), a grouping of over ten governments united in halting the extraction of fossil fuels (California Air Resources Board, n.d.; Gouvernement du Québec, 2021). These policies can be understood as two-fold. Namely, they allow the Legault government to reconcile its mission with the electorate's environmental worries, while boosting the province's image as a leader in climate policy, both nationally and internationally (Gajevic Sayegh et al., 2022). Both goals are reflected in the government's recent *Stratégie gouvernementale de développement durable 2023-2028*, a plan aimed at "creating wealth while protecting the health and well-being of Quebecers [and] making Québec a center of

innovation and excellence in the green and responsible economy"[2] (Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs, 2023).

While the use of ecological fiscal policy instruments to stimulate sustainable economic growth and promote citizens' welfare are discussed in the plan, food waste governance – an area of particular interest for my study – remains overlooked. In 2021, the agri-food sector accounted for about 6% of the province's economy, while emitting 20.2 million tonnes of CO_2, of which 39% were attributed to food waste (Ministère de l'Agriculture, des Pêcheries et de l'Alimentation, 2022; Recyc-Québec, 2022). Of these wasted foods, nearly 18% were potentially edible (Recyc-Québec, 2022). The potential for emissions reduction in the agri-food sector is thus high, especially when considering early waste prevention strategies in food supply chains.

A main objective showcased in the Legault government's *Stratégie gouvernementale de développement durable 2023-2028* that could turn the tide on waste and other inefficiencies is the development of the province's nascent circular economy, presently accounting for only about 3.5% of its economic activity (Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs, 2023). This goal directly impacts Québec's upcycled food sector, as such circular economy initiatives would benefit from increased financial incentives in the form of tax breaks or subsidies. While the plan does identify the biofood sector as a prioritized locus for economic circularity, it fails to address the specific ways in which the government plans to achieve this transformation. For example, the Center for Intersectoral Studies and Research on the Circular Economy (CERIEC) argues that the strategy lacks coherence, highlighting the absence of clear governance and fiscal guidelines necessary in promoting various waste valorization (CERIEC & ÉTS, 2023b). While the government does acknowledge the importance of composting to divert organic waste from landfills by encouraging multi-level and public-private waste coordination, this end-of-life valorization process does little to promote innovation within the biofood sector, one of the plan's initial targets (Ministère de l'Environnement et de la Lutte contre les changements climatiques, 2020; Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs, 2023).

[2] Translated from French by the author.

One promising avenue the plan puts forward is the creation of funds and grants to assist sustainable entrepreneurship initiatives. For instance, the *Fonds Écoleader* is an initiative founded by the Minister of Economy, Innovation and Energy to financially support businesses in their sustainable activities, while providing them with environmental consulting services. The *Compétivert* initiative, funded by Investissement Québec through the provincial government, seeks to achieve the same goal with a particular focus on green technological innovation (Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs, 2023). Other governmental bodies such as Recyc-Québec offer similar financial support to businesses (CERIEC & ÉTS, 2023a). However, while the economic incentives for sustainable entrepreneurship set by the provincial government seem to multiply, the financing of circular economy initiatives largely rests on the shoulders of the private sector. Provincial financial actors such as Desjardins and, *Fondaction* and the *Fonds économie circulaire* directly work with food waste valorization businesses to create mutual growth (CERIEC & ÉTS, 2023a). International venture capitalist groups such as Cycle Capital and the Circular Innovation Fund are increasingly active in Québec, especially in large cities such as Montreal (CERIEC & ÉTS, 2023a). What is especially noteworthy, is the various partnerships that characterize the upcycled food industry and, more broadly, the province's circular economy sector. Indeed, while these governmental and private actors help fund the sector's activities, its technologies are informed by both research and advocacy groups. For instance, CERIEC and *Québec circulaire* produce reports on current unsustainable industry practices and potential poles for circular innovation, and critically analyze current environmental policies, proposing implementable strategies to increase economic circularity (CERIEC & ÉTS, 2023a). Other administrative actors such as *Synergie Québec* produce extensive regional databases of local circular businesses, facilitating partnerships through technology and knowledge transfers and the exchange of input materials (Synergie Québec, n.d.).

3.1: Study area conclusion

In summary, the Legault government's sustainability efforts can be understood as asserting the province's economic autonomy from the federal government, with the Québécois identity perceived as under threat. While the government seeks to promote sustainable entrepreneurship and drive environmental innovation, circular economy strategies, while present in its public

discourse, lack coherent guidelines for further implementation. The conceptualization of the province's political climate is thus useful in understanding how such upcycled food initiatives come to fruition. Indeed, because of Quebec's limited food waste governance framework, private financing and partnerships are beginning to fill these niches, using environmental externalities such as waste to generate profit. In other words, as this industry has little governmental oversight, upcycled foods entrepreneurs have more creative freedom in developing innovative technologies and recipes to counter the growing issue of food waste.

CHAPTER 4: METHODOLOGY

In this chapter, I outline the methodological approach used in my research. I begin in Section 4.1 by describing the participant demographics and the interviewing process. In the following sections, I discuss my sampling strategy, recruitment process, interview structure, and analysis techniques. Further, in section 4.2, I explain the relevance and use of social network analysis to map partnerships in the sector. In section 4.3, I reflect on my positionality as a researcher and its potential influences on data collection. Finally, in Section 4.4, I explore some of my methodology's limitations. This research was conducted with the approval of the Research Ethics Board of McGill University (see Appendix A).

4.1: Semi-structured interviews: recruitment and participant demographics

I conducted interviews with six of the estimated fourteen companies involved in Québec's nascent food upcycling sector, totalling to a sample of eight interviewees. Among these actors, six were the CEOs and founders of their respective companies, while the other two were heads of marketing. The sample in my study was disproportionately male, with seven of the eight interviewees identifying as male. In total, the interviews reflect the journeys of six disparate types of food upcycling companies as well as one circular food distribution platform. Five of these six companies are based outside of Québec's largest urban centres (comprising Montréal, Québec City, and Gatineau). Further company characteristics are discussed in Chapter 5. To conduct these interviews, REB approval was obtained from McGill University (REB #: 23-09-039).

4.1.1: Sampling and recruitment

Candidates were selected through a mix of purposive and snowball sampling. Indeed, a preliminary sample of companies of interest was identified during my visit to the *Expo Manger Santé Vivre Vert*[3] in Montreal in March 2023, before commencing this research. This health food convention showcased a multitude of local food producers, with a particular emphasis on alternative food vendors such as those sampled. Based on this, I focused on companies that transform either unsold produce or agricultural surpluses into new food products. To broaden my sample, I scanned each company's social media platforms (e.g., Instagram pages), a circular food distribution platform, and the Québec Circulaire's database of circular agri-food initiatives (www.quebeccirculaire.org). Drawing from this, I constructed a database of 12 Québec-based

[3] See https://expomangersante.com/photos2023/.

upcycling food companies. After contacting all these companies via e-mail, six agreed to be interviewed. At the end of each interview, I asked if there were any other actors of interest either involved in Québec's circular food economy or facilitating the company's operations. Through this process, I was provided with additional names (n = 2) and contact information for a distribution platform and one of the company's head of marketing. While the database I compiled may seem small, to my knowledge, it represents most of the companies that currently identify as part of Québec's upcycled food sector. This was later confirmed through snowball sampling, as the same companies or partners were mentioned during different interviews.

4.1.2: Interview structure

Between September and November 2023, I conducted 8 semi-structured interviews (see Appendix B for the interview guide). This method, based on open-ended questions, ensured that the focus remained on the studied topic while allowing for some flexibility in pursuing any related topics brought forth by participants (Gubrium & Holstein, 2002; Adeoye-Olatunde & Olenik, 2021). All interviews were conducted remotely, either by phone (n = 3) or by videoconferencing using the MS Teams platform (n = 5). Consent forms for the meeting's audio-recording were sent before the interviews via e-mail and completed prior to the scheduled interview. All participants agreed to be audio-recorded. Active consent was received at the beginning of each interview, as I explained the research aim and asked if the participants had any worries or questions before we began. Seven of the interviews were conducted in French and one was conducted in English. The excerpts from my interviews presented in my results chapters are translated from French to facilitate the reader's comprehension.

4.1.3: Qualitative analysis

Following the interviews, I transcribed the recordings in a word processor. Before beginning the thematic analysis process, I made a list of *a priori* and *a posteriori codes* regarding the involved actors, relationships along the supply chain, and challenges and opportunities in working with upcycled foods. On separate printed copies, I then manually coded the transcripts by highlighting each of these themes, ensuring the proper organization of my results. As reported challenges in the industry were quite homogenous across the companies, I created a summary table tallying the frequency at which issues around supply, food preservation, labor, and social acceptability were

mentioned. I present these results in Chapters 5 and 6. I made sure that the participant's confidentiality was respected throughout the dissemination process, only describing their general roles at their workplaces. The companies, in turn, were ascribed numbers from the following distribution: C1, C2, C3, C4, C5, C6; and only their overall production and marketing processes will be described herein.

4.2: Social network analysis

As a common method in social sciences, social network analysis is used as a tool to analyze relations between different actors, illustrating the diverse forms of interactions and knowledge flows characterizing the studied network (Ter Wal & Boschma, 2008). For my study, I defined actors as companies, non-governmental organizations, and governmental bodies involved in Québec's food upcycling sector. In turn, the relations along the network reflect the various inter-organizational contacts who either directly work towards the commoditization of upcycled foods, or facilitate their production using politics, capital, or social advocacy (Knoke & Yang, 2008). To produce a network graph depicting the broad types of relationships that emerged from my interviews, I used the online software 'draw.io'. Specifically, using the codes I applied for actors mentioned in the interviews, I produced a directed social network graph with arrows (edges) linking each actor (nodes) to the other. To further aid my interpretation, I generated a 'socio matrix' tallying the frequency of the illustrated relationships (Knoke & Yang, 2008). The social network analysis' results are presented in chapter 6.

4.3: Positionality considerations

As a young researcher, I reflect on how social hierarchies pertaining to my gender, education, age, and former work experience have affected my positionality throughout the conduction of my interviews (Gubrium & Holstein, 2002). This process of reflexivity is especially critical in recognizing "the politics and practices of the social world" (King & Horrocks, 2010: 126) as embedded in research outcomes. For instance, as I was working with a mostly male-based sample in positions of authority, it was hard not to feel a sense of unease as a woman, echoing historical relations of gendered subjugation. This feeling was further heightened by underlying power imbalances between I, the researcher, and the participants' roles (Gubrium & Holstein, 2002). Indeed, six of the eight interviewees were CEOs, which gave me little leverage during our

meetings. This issue of credibility also relates to my educational background and age. As a young scholar writing my thesis as part of my undergraduate Honours program, certain participants or other contacted actors did not seem to take my work as seriously as that of a more senior researcher, potentially explaining their hastiness during the interviewing process. Finally, as a former community worker operating in the field of food security, it was difficult at times not to be critical of the companies' food affordability claims. Indeed, as most of the studied products were at a price premium, they remain inaccessible to a large part of the population. Thus, to avoid potential research biases, I made sure to develop a more impartial interview guide with my supervisor. To address arising positionality concerns throughout my research process, I continued to practice reflexivity by keeping a diary (Dowling, 2016).

4.4: Limitations of methods

Although I use a mixed-methods case study approach that draws on my qualitative data in disparate ways, the semi-structured interview component of my analysis is based on a relatively small sample. My response rate was also quite low: eight of the twenty-five contacted actors agreed to be interviewed. Interviews were also often cut short due to the participants' lack of time. Indeed, the average length of my interviews was around twenty-two minutes. While I believe that the number of participants is sufficient in drawing comprehensive profiles for each company – as I mainly spoke to their respective CEOs – the sample's lack of diversity does not offer a broad picture of Québec's emerging circular agri-food industry. Namely, my study provides a limited understanding of other actors' roles in the facility and governance of this sector, especially those of community organizations and grassroots initiatives. Finally, as this remains an exploratory study, the impact of upcycled foods on wider socioenvironmental processes such as food security and sustainability are also not discussed.

4.5: Methodology conclusions

In this chapter, I discussed the methodology underlying my research. I began by introducing the demographics of the study's eight participants. I then described my interviews' sampling procedure, the interviewing process, and the basis of my thematic analysis. Next, I explained how social network analysis and was relevant in studying partnerships in the circular food economy sector. I then discussed how my positionality as a young female scholar interacts with my

research. Finally, I discussed some of my methodology's limitations regarding the sample size and limited reach. In the next chapters, using this mixed-methods approach, I present the companies' commodity chains and explore their various successes and challenges.

CHAPTER 5: THE COMPANIES AND THEIR COMMODITY CHAINS

In this chapter, I describe the interviewed companies' main characteristics and provide a broad comparison of their commodity chains. In section 5.1, I introduce each company, providing a brief description of their products and identifying their main suppliers and points of sale. In section 5.2, I classify each company as either an 'alternative' or 'novel' upcycled food producer using Aschemann-Witzel et al.'s (2023) distinction of upcycled foods. 'Alternative' producers are those who repurpose otherwise wasted foods into new ones, whereas 'novel' use ones transform an inedible byproduct into an edible food. I use this classification to draw and analyze two generalized commodity chains, highlighting the main ways in which food waste is created, discarded, redistributed, and upcycled across the province's food transformation and distribution systems.

5.1: Company characteristics

In this section, I share the main characteristics of each company based on my interviews with eight stakeholders in the province's upcycled foods sector (see Appendix C for an overview). These companies have diverse operations and entail multiple types of upcycling. Company 1 (C1) produces crackers from brewers' spent grain, which are then sold across the province in large chain and small grocery stores. Company 2 (C2), on the other hand, uses discarded fruit parts from processing facilities to manufacture fruit snacks for specialized and gourmet stores. Company 3 (C3) works directly with farmers and local producers to transform their agricultural surpluses into prepared meals, then sold to small grocery stores. Both companies 4 and 5 (C4 and C5) utilize fruit and vegetable surpluses from local and global distributors to produce drinks for small and large retailers. Finally, Company 6 (C6) diverts unsold vegetables from local distributors into fermented foods sold in retail chains and independent grocers. C1, C4, C5, and C6 are thus more geographically accessible across the province, as per their availability in large chain grocery stores. While C2 and C3 are still in their relative infancy, all interviewees reported selling their products both online and through online food basket delivery platforms, such as Lufa Farms or Marché SecondLife. This final remark highlights the upcycled food movement's embeddedness in previously mentioned healthy and sustainable eating trends, central to the platforms' mission.

5.2: Commodity chains

Following Aschemann-Witzel et al.'s (2023) upcycled food classification, C3, C4, C5, and C6 represent an 'alternative' type of product, as their supply stems from unsold produce resulting from agricultural surpluses or poor distribution logistics. C1 and C2 produce, on the other hand, produce 'novel' upcycled foods, as their supplies derive from the remnants of past agri-food transformation processes. The commodity chains for 'alternative' and 'novel' use companies, respectively, are presented and analyzed in sections 5.2.1 and 5.2.2.

5.2.1: 'Alternative' use commodity chain

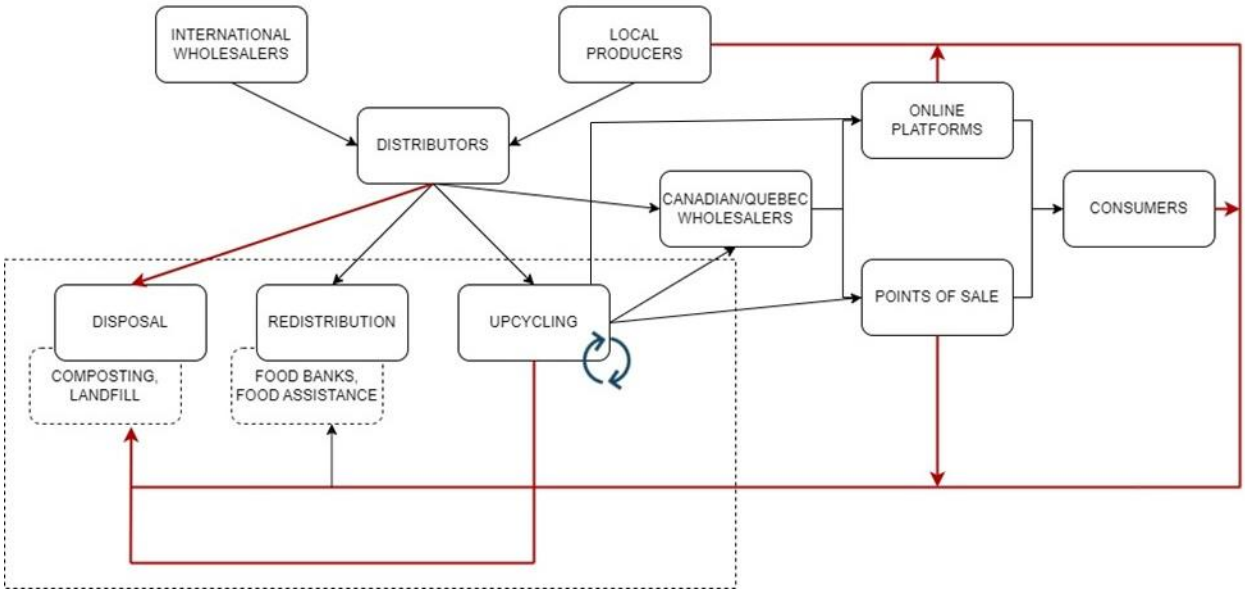

Figure 5.2.1 **Generalized commodity chain for 'alternative' use upcycled foods.** This chain is based on the information provided in interviews with representatives of four companies (C3, C4, C5, and C6). Each actor and transformation process involved is illustrated using a rounded box. Black arrows represent the flow of supplies and upcycled foods within the chain, whereas red ones show where food loss occurs. The dotted rectangle indicates which part of the chain deals with food waste management. The blue circular arrow shows the repurposing of food upcycling byproducts. (Source: Author)

In a linear food distribution system, Canadian distributors acquire their supply through both international wholesalers and local producers. Distributors of international produce are commonly known as 'importers', working with third parties along the global food supply chain, whereas local distributors work directly with farmers or farmer's associations. In any case, the distributor is the intermediary between the supply and demand for fresh produce. Both local and imported products

are then sent to national and provincial wholesalers who supply grocery stores and food distribution platforms operating online, finally making their way to the consumer. Waste, of course, occurs across all stages of the commodity chain, from production to consumption (see Appendix D for a detailed breakdown of waste along the chain). Here, however, I focus on the distribution stage, the one in which 'alternative' use companies operate.

Food distributors usually discard their surpluses or ripening produce either through charitable donations, or in landfills and composting facilities. While it is difficult to assess exactly how much food is redistributed or wasted, Recyc-Québec (2022) estimates that nearly 45% of the province's edible wasted food is lost from the stages of production to distribution. Because this waste occurs at the beginning of the chain and consequently stems from second grade produce with minimal flaws, this area of intervention is especially relevant to 'alternative' use companies, as it provides them with a good quality supply for lower prices. As the representative of C6 explained:

> There are so many surplus veggies at the first level of the supply chain that gets thrown out and are composted immediately. They never make it to a grocery store shelf [C6, November 17, 2023].

Further, three out of four 'alternative' use companies source some, if not all, their supply from importers (or international produce distributors), whereas two out of four opt for local foods distributors. Only C3 has a fully locally sourced supply. These findings show that the embeddedness of such initiatives in both global and local markets offer a potential solution to small and large-scale environmental externalities caused by inefficient food systems.

Moving down the chain past the companies' supply source, saved foods are then upcycled using various technologies such as lyophilization ('freeze-drying'), juicing, and lacto-fermentation. Once the final product is ready to be manufactured, a company's shipping process depends on its points of sale. Indeed, the larger companies who produce greater volumes of food describe working with wholesalers, who then ship the products in their various chain grocery stores or leave them in their warehouse for online deliveries. If a smaller company wants to access such stores but is unable to produce large enough volumes of its product, it can opt for a 'backdoor' delivery. This requires a company representative to go on the ground and pitch their product to an individual chain grocery store's manager who, if money and shelving space permits, may agree to display it. However, this practice is especially time-consuming. As the head of

marketing of C1 put it: “It's exhausting work. It’s a lot of door-to-door with little guarantee for success” [C1, November 7, 2023].

Such companies thus prefer selling their products to smaller points of sale or via web platforms, either directly or through a tertiary delivery service.

A final characteristic that distinguishes ‘alternative’ use companies is their integral use of waste. Indeed, while they do inevitably throw away a fraction of their unusable waste, most of them try to fully use their byproducts or reintroduce them to the market through various partnerships. For instance, C4 uses fruit and vegetable pulp to manufacture its own soaps. Additionally, C6 uses the brine of its fermented foods to make sauces and condiments, producing a type of ‘novel’ upcycled food with their own waste. As its representative explained:

> We used to have little veggie and brine leftovers, so it was about finding a way to double ferment. We are kind of adaptable to the flavors of the sauce based on surplus that we have in the actual facility [C6, November 17, 2023].

Partnerships, on the other hand, allow the industry’s small stakeholders to access input materials that would otherwise require greater costs and transformation processes. Coming back to the pulp example, C4 also works with an upcycled baked goods company, who uses this byproduct in its confections. ‘Alternative’ use companies are thus aware that even through the diversion of fruit and vegetable waste at the start of the food system, waste is an inevitable part of their transformation processes. However, contrary to linear modes of production, they make sure that the disposal of their byproducts is minimized and always composted.

5.2.2: 'Novel' use commodity chain

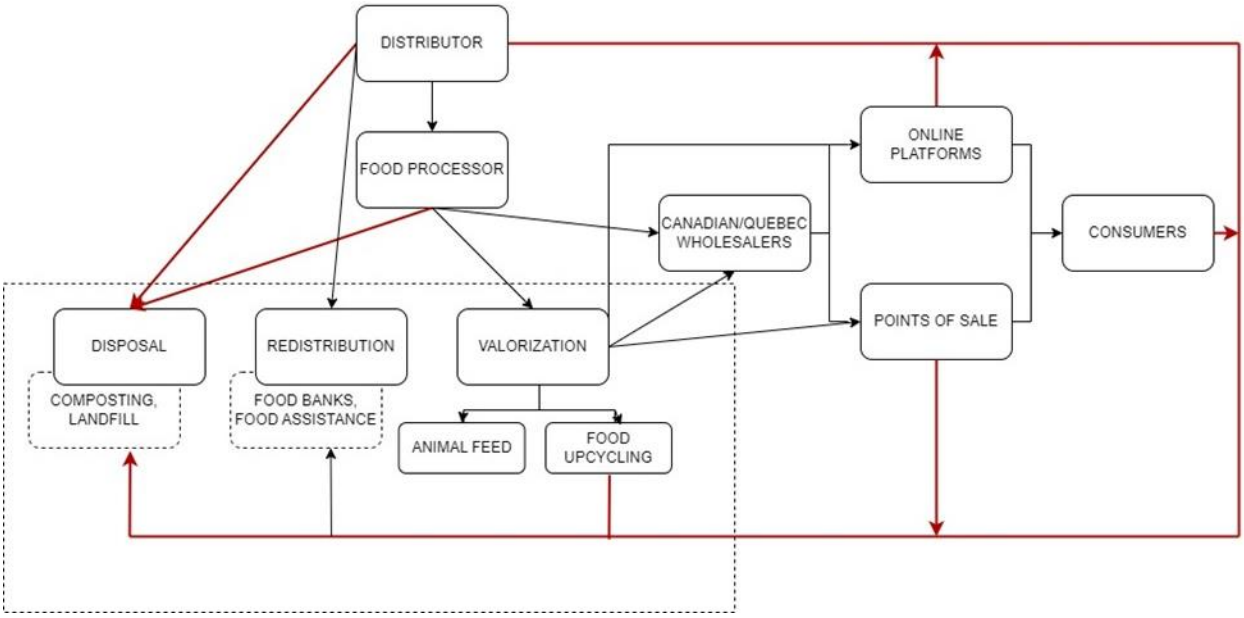

Figure 5.2.2: Generalized commodity chain for 'novel' use upcycled foods. This chain arises from interviews with C1 and C2. This commodity chain operates within the same principles as Figure 5.2.1, but for 'novel' use upcycled foods. (Source: Author)

'Novel' use upcycled foods companies operate similarly to 'alternative' use ones, meaning that their manufacturing and commercialization processes depend largely on the company's size and production volumes. However, they have some key differences related to supply and production, characterizing them as a distinct form of edible commodity. As previously explained, 'novel' use upcycled foods deal with the transformation of industry by-products. Their supply typically comes from the discards of a previous food processor. For C1, this involves a few large-scale breweries, whereas for C2, this supply stems from fruit processing facilities. In both cases, however, the companies use parts of an original product that, past the point of transformation, are deemed unfit for human consumption. These initiatives thus divert food waste at a later stage in the food chain, as 'alternative' use companies supply themselves with agricultural surpluses and 'novel' use ones focus on post-processing waste reduction. Their supply source can thus be characterized as local, as they work with waste at a municipal level.

Another insight from these initiatives lies in the unique research and development technologies required to manufacture them. Indeed, while produce surpluses can be donated or used in their integrity to make new foods, the 'inedible' nature of products stemming from anterior food processing renders them unusable for industries oriented toward human consumption.

Compared to the 'alternative' use model, food redistribution in the 'novel' use chain thus always occurs at the distribution and commercial level, never after processing, as foods at these stages are still relatively intact.

Interviews with C1 and C2 covered how industry byproducts are usually composted, discarded in landfills, or, in the case of cereals, turned into animal feed. This area of intervention in creating a new use for these byproducts thus represents a locus for innovation in the upcycling food sector, as it requires a considerable amount of research and development, from recipe conception to machinery design. C1 for instance, had to find a recipe that dealt with the chemical instability of its input materials. As the company's CEO explained:

> Brewer's spent grain is very unstable after fermentation. It's a very hot material and, if not handled quickly, it produces a second spontaneous fermentation in just a few hours […] we needed help with recipe conception to safely deal with this issue [C1, October 20, 2023].

C2, on the other hand, had to design and develop its own extraction machine, as no such projects had been previously done in the province. 'Novel' use upcycled foods thus require a greater level of technological sophistication than their 'alternative' counterparts.

A final difference between the two stylized commodity chains rests in the 'novel' use companies' waste disposing practices. For example, the 'alternative' use companies' transformation processes inevitably generate byproducts that are inedible, while the 'novel' use ones do not, as they are already using such derivates as their input materials. While a red arrow in my generalized commodity chain diagrams depicts the links between the food upcycling process to waste generation, this residual waste is minimal, and composting is preferred when triage of rotten material at the processing plant is not adequate. Additionally, as opposed to 'alternative' use companies, 'novel' use ones cannot repurpose their scraps, usually composed of hard peels and other unusable materials which are not readily manufacturable on the market or useful to other valorization initiatives.

5.3: Chapter conclusion

In this chapter, I introduced and characterized the six studied companies, describing the type of product they manufacture, their main supply source, and their points of sale. I then illustrated the upcycled foods using the 'alternative' and 'novel' use framings, a distinction then used to categorize the companies and draw two generalized commodity chains. When analyzing the

commodity chains, I described the linear trajectory of waste in a traditional food chain and explained the areas of intervention of both company categories. Through these comparisons, three main differences emerged. Namely, that 'novel' use companies operate at a later stage in the food chain, that they rely on greater technological sophistication, and that they produce a smaller amount of reusable waste.

CHAPTER 6: THE PERCEIVED CHALLENGES AND OPPORTUNITIES OF FOOD UPCYCLING

In this second results chapter, I disseminate the interviewed companies' perceived challenges and opportunities, exploring some of the coping strategies they employ to mitigate these difficulties. In section 6.1, I explain how social acceptability, supply, volume, and representation constitute the biggest self-reported difficulties in food upcycling. In section 6.2, I relate these findings to the technical coping strategies used by stakeholders in this industry. Further, using a social network graph, I explain how relationships and partnerships facilitate the activities of this nascent industry. Finally, I review some of the reported opportunities of circular food economy operations related to input material costs, marketing, sale, and technology availability.

6.1: Self-reported challenges

Based on my interviews, the three most prominent challenges perceived by the interviewees were those of social acceptability, supply consistency, and production volume. Here, social acceptability refers to consumers' willingness to pay for and consume the studied upcycled foods, directly shaping the demand for such products. Supply consistency relates to the input materials' homogeneity and year-long availability, this variable affecting transformation operations. Production volume – or, in this case, output capacity of a company – is an important condition for a company's commercial scalability and profitability. Below, I characterize each challenge, explaining how they affect the studied companies' operations.

6.1.1: Social acceptability

Social acceptability represents by far the largest difficulty faced by stakeholders. Indeed, five out of the six interviewed companies reported that this challenge was encountered multiple times since the start of their operations. Many of them described how upcycled foods were commonly pictured as derivatives of rotten foods. The representative from C5 noticed a subsequent psychological barrier that hinders both the marketing and consumption of these foods. He explained:

> People just aren't aware that industry and societal standards create 'number twos'. A lemon might have a line on it, so grocers won't be able to sell it, but that lemon is completely fine [C5, November 15, 2023].

Most notably, this misconception not only affects consumers' willingness to pay for and consume such products, but social acceptability also shapes grocers' and other industry partners' eagerness to support or finance these initiatives. Social acceptability is thus self-reinforcing, as consumer attitudes shape the biofood industry' willingness to partake in food upcycling.

However, this reluctance to consume upcycled foods does not only stem from common misunderstandings around their supply's safety. Indeed, brand loyalty also plays a crucial role in determining consumer behavior. The representative from C1, noted that:

> When it comes to the circular economy sector, we are not in competition with other circular companies, but with multinational corporations, the ones people are most acquainted with when shopping […] I think that taste and price remain the main purchasing predictors, upcycling is just a plus [C1, October 20, 2023].

Thus, by opting for large name brands, consumers are choosing products that they are familiar with and that can be manufactured more cheaply, consequently impacting smaller local companies who are attempting to get their products on a chain grocery store's shelf.

While both concerns remain omnipresent for the companies, three of the five who reported this difficulty argue that social acceptability has gotten better with time. More specifically, brand loyalty still poses a major barrier in stimulating upcycled foods consumption, but misconceptions around their safety appear to have waned over time. The representative from C6 explained:

> In 2021, when we were starting our first big year of selling to grocery stores, a big part of my job was explaining to people what an upcycled food product was. […] Today, I can't remember the last time I ever did that […] it's become much more mainstream [C6, November 17, 2023].

This trend could thus paint a more hopeful picture of consumer demand for such products, a useful observation in studying their commercialization and marketing.

6.1.2: Supply inconsistency and instability

The second biggest challenge that was met by four of the interviewees was supply inconsistency. They collectively described how supply inconsistency occurs across two spheres, namely input material availability and handling. Input material availability affects all types of upcycled food companies, but especially those who use fresh produce and their derivates, as produce availability fluctuates year-long and is dependent on environmental, economic, and geographic factors. More specifically, the fresh supply's seasonality and the factory's location constitute the

main predictors of its accessibility. Handling, on the other hand, mostly affects 'novel' use companies, as they work with unstable byproducts that must be efficiently collected and stored after being recovered from the food processor's initial stages of transformation.

When considering availability, seasonality was the most commonly stated challenge for 'alternative' use companies. Indeed, as seasons change, local and global agricultural outputs differ in their content, quantity, and even quality. Adapting to this change can thus be especially difficult for these companies, as agricultural surpluses depend on said variables. Additionally, these surpluses are also impacted by a myriad of external factors such as supply management and market demand. Thus, creating a standardized and homogenous product from this fluctuating supply can prove tedious. As one company representative put it:

> The main challenge is having a final product that you know can be adaptable to that kind of inconsistency. […] It's finding a product that can be adapted slightly in order to work with the real time availability of the vegetables [C6, November 17, 2023].

For companies that are geographically distant from large centers or supply sources, this challenge is even greater. This is especially true for 'novel' use companies who need specific kinds of byproducts as their input material. The representative from C2, explained that he had to relocate his processing plant to a city that was closer to the fruit processor who supplied him, as transportation costs and distance slowed his activities. However, this seems to be less of an issue for 'alternative' use companies, as they can alternate between the distributors who supply them.

Handling also appears to be a challenge that mostly affects 'novel' use companies. Here, handling refers to a byproduct's adequate collection and immediate initial processing. For instance, the representative from C1 explained that, when working with brewer's spent grain, material collection and cooling must be done under 24 hours. This is to avoid a second fermentation, as such grains are chemically unstable at room temperature. C4, who supplies other companies with its fruit and vegetable pulp after manufacturing his drinks, noted the same challenge, as he must first stabilize these byproducts before reintroducing them to the market. Collection and cooling must therefore happen quickly, to ensure the supply is not lost. For C2, the biggest handling challenge was with his supplier's triage practices. Its representative explained:

> In larger facilities, we developed a specialized tool to minimize the triage work in our factory, but that effort wasn't successful. Employees weren't very careful when handling the equipment [C2, November 7, 2023].

Thus, a certain volume of the byproduct at the fruit processing plant may be accidentally wasted or improperly collected due to human mistake.

6.1.3: Production volumes

The third most common challenge was production volume. Indeed, four of the six interviewed companies reported struggling with this issue. This finding is critical, as large volumes allow for commercial expansion to large chain grocers and financial scalability. More specifically, identified difficulties in this realm were threefold, as they related to a company's transformation facility, its use of technology and automation, and the budget it allocates for the sale of its products. All these challenges reflect the financial hardships of establishing an upcycled food start-up and, as a few interviewees said, can also be generalized to the agri-food sector as a whole.

For instance, C2's representative explained that larger chains require certain certifications that are not only pricy, but that can also only be achieved in larger food-grade production facilities. Start-up food companies, however, tend to start in smaller facilities, as their rents are cheaper, thus allowing them to maximize their profits. He explained that even when meeting the industry's safety standards, his factory was not originally designed for food production, which impeded his certification process. It is one of the many reasons that prompted him to relocate his activities to another city and facility, despite the higher financial costs he is now facing. Thus, to produce larger output volumes and access bigger markets, companies must incur these certification and production costs, a practice which is not always feasible for companies at different stages of their development.

Additionally, automation was identified as another barrier for greater outputs. All interviewees who identified volume as a production challenged explained that, in order for a agri-food business to be scalable, its operations must be automated. The representative from C3 mentioned that labor is expensive but necessary in a company's early stages, as it lacks the funds for sophisticated machinery. He explained:

> I'd say the challenge is to have volumes large enough to afford the worry of automation that allows for more competitive products [C3, November 7, 2023].

In this case, volume and automation are self-reinforcing, as larger volumes allow for companies to afford such technologies, consequently reducing their product's price and increasing its competitiveness on the market. This creates a greater demand for the product, leading to a larger

production capacity. The automation step, however, is also dependent on the company's profitability, just like certification is.

Finally, while selling products to large chain grocers was identified as a potential pathway to commercial expansion and increased production volumes, this process remains long and expensive. Indeed, C1's head of marketing explained that even when a company manages to produce the kind of volume necessary to supply large chain grocers, they must make a careful cost benefit analysis. More specifically, he explained that, when getting their products on a grocery store's shelf, companies must first pay an adhesion fee to the chain they work with. Companies further pay a fixed amount of money for each flavor they sell to that specific chain. Then, grocers take a certain percentage on the sales the company makes in-store. As he put it: "In the end, we make less money, but with greater volumes sold" [C1, November 7, 2023]. Expansion to larger markets is thus costly, a risk that needs to be carefully weighed when considering partnerships with large grocers.

6.2: Technical and social coping strategies

To examine how companies are responding to some of these challenges, I describe below the diverse strategies interviewed companies mentioned that they have employed since their inception. These strategies can be classified as either technical or social. Indeed, technical strategies refer to the ways in which companies operate from within to increase efficiency and resilience. Here, I explain how certain company adaptations have bettered social acceptability and supply inconsistencies. However, I note that social relationships and industry partnerships are by far the most effective ways to reduce such issues and facilitate food upcycling, from the stages of a product's design to its sale.

6.2.1: Technical coping strategies

To better their products' social acceptability, interviewees identified two main strategies, namely labeling and branding. Indeed, C1's representative explained that, by getting his products certified by the Upcycled Foods Association, his company is now not only part of the network's extensive database, but this label also provides it with a level of legitimacy that promotes consumer trust. Similarly, most companies also mentioned the benefit of labeling their products as local, with the province's 'Aliments du Québec' logo. As the company's head of marketing put

it: “there is a real boom in products from Québec, and in our case, the circular economy always interests people” [C1, 2023]. Upcycled foods thus seem to tap into a market that is increasingly expanding. Additionally, packaging that highlights the healthfulness of these foods confers them with a marketing advantage, as all companies reported promoting their products as healthier alternatives to generic brands. Finally, the representative of C2 noted the importance of a product’s branding and package design, as its aesthetics may spark consumers’ curiosity and increase its consumption.

To counter supply inconsistencies, interviewees mentioned how preservation methods were extensively used in food upcycling. Such methods meant to extend shelf-life usually include either exclusively – or a mix of – freezing, drying, and fermentation. As the founder of C5 explained:

> When working in the circular economy, you might get 26 pallets of berries today, but won’t get any for the next three months. If I need these berries for the next few months, then I need to find a way to preserve them in advance. So, we process them, freeze them, and then take them out when we need them [C5, November 15, 2023].

This shows a certain flexibility in the companies’ operations, as they must adapt their processes to the types of available inputs. Finally, focusing on a main category of input material was identified as another coping strategy to this inconsistent supply. The representative of C2 explained:

> At first, we wanted to save as many kinds of produce as possible, so our packaging was generic, allowing us to write which products were saved the day of processing. People didn’t understand what we were doing, so we had no choice but to focus on one kind of produce to efficiently commercialize our final product. There wasn’t really a way to work with small volumes of different things, so we had to start working with one larger supply [C2, November 7, 2023].

Thus, choosing one main input material, whether that be a byproduct or specific type of fresh produce, not only helps with supply acquisition, as the supply source becomes steadier, but also with production volumes, since the final product becomes more homogenized and marketable.

6.2.2: Social coping strategies from a network perspective

Upcycled food companies form a collaborative industry, where both companies and non-profits work together to facilitate the collection, transformation, and commercialization of waste. These partnerships occur across four stages of the companies’ operations, namely product conception, supply sourcing, transformation operations, and sales. To analyze these partnerships, I use a basic

network graph, highlighting the ways in which input materials, technologies, and knowledge are shared between the studied companies and their facilitators. The facilitating actors are both private and non-profit entities, highlighting a unique characteristic of mission-driven entrepreneurship.

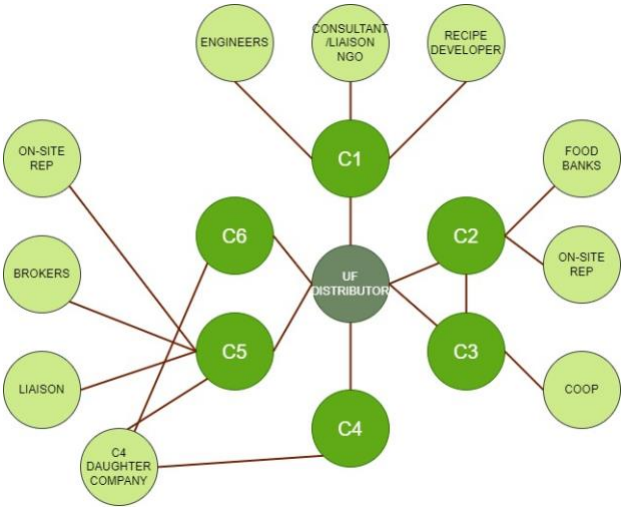

Figure 6.2.2 Social network graph of facilitating actors emerging from interviews. Each node represents an actor, and the links highlight the network's diverse partnerships. Each color represents a different category of actor, as the darker one represents a common distributor, the bright one represents the companies, and the pale one, the facilitators. Note: this graph should not be interpreted as an exhaustive depiction of all possible social relations, as it only depicts actors and relationships specifically mentioned during the interviews. (Source: Author)

Indeed, collaboration is quintessential in designing a marketable product. When looking at C1, this example is evident, as the company employed both a recipe developer and an engineer at its early stages of development. More specifically, the engineer was helpful in teaching the company how to stabilize its input material, while designing some of the more specialized machinery necessary for the conception of the product. The recipe developer, on the other hand, allowed C1 to turn a neutral and bland stabilized material into a palatable snack. While product design was not mentioned by any other company during the interviews, it is safe to assume that, since many of these initiatives rely on novel technologies, part of their expertise must be outsourced from consultancy companies or other professionals, suggesting that this network is much larger and varies over time, at different stages of a company's growth. This phenomenon is especially noticeable at the transformation stage, wherein transfers of knowledge and technology between well-established companies and smaller ones is omnipresent. For instance, because C3

is not yet a stage in which it can afford pricy machinery, C2 agreed to share some of its lyophilization technology and know-how to aid its nascent business.

In terms of supply sourcing, C1 has established a partnership with its region's biofood council. This non-profit liaises upcycling initiatives with industry actors who wish to reintroduce their waste to the market. In this way, if C1's usual brewers cannot supply it with the necessary quantity of spent grain to maintain their regular operations, they contact this organization, tasked with finding an alternate supply source. Other companies, such as C4, have taken matters into their own hands through the creation of branches charged with this very mission. In C4's case, its daughter company offers both upcycling consultancy services and collects agricultural surpluses and byproducts, which they then stabilize and sell to other upcycling companies. At the beginning of its operations, C6 used the company's services to source its vegetables. However, as it has now substantially grown, it is exploring other supplying avenues. Moreover, C5 is building its very own branch that specializes in the collection and sorting of surpluses, but that only supplies its own factory. Supplying also depends on the input material's embeddedness in local food systems. Indeed, because C3's mission relies on the valorization of exclusively local surpluses, it has established direct partnerships with local farmers through its region's agricultural cooperative, highlighting another non-profit to private partnership. Such relationships with the non-profit sector manifest differently with an urban supply. For instance, while C2 mainly uses discarded fruit parts from processing plants, it also uses grocer's surpluses at times to diversify its flavors. However, before buying what is left in grocery stores, the company makes sure food banks first collect the supply they need, allowing for a mutual and concerted relationship.

Finally, partnerships are also crucial in facilitating sales and the economic expansion of upcycled food initiatives. For instance, all interviewed companies operate with a distribution platform specializing in upcycled food commercialization, showing a real sense of community and mutual aid in mainstreaming this food movement. On an individual level however, interviewees explained that sales can be facilitated by three main agents, namely on-site representatives, brokers, or larger companies in the industry. Indeed, on-site representatives work for the distributors employed by upcycled food companies to deliver and sell their products. Representatives are thus the ones who take care of sales in the identified stores, of which distributors then take a cut. Brokers, on the other hand, are hired directly by companies and are

in contact with different Canadian retail companies. They then build backorder relationships, so that products can be added to the identified stores' shelves. Additionally, for some time, C5 sold part of its products through C4's online platform, as the latter company was more established in the market than the former. However, as is the case with other variables in the commercialization process, partnerships between upcycled food companies are usually temporary, until smaller companies acquire the knowledge and means necessary to expand their operations. Partnerships with other industry actors, however, seem to be established on a long-term basis, as a substantial flow of money is involved in maintaining these relations.

6.3: Perceived opportunities

While the companies are still faced with numerous hurdles as the upcycled food industry is expanding, interviewees were fond of sharing their positive experiences, and showed a sense of pride at the entrepreneurial journeys they each undertook. As previously mentioned, one of the main opportunities in this industry is the partnerships it fosters. These partnerships allow companies to solve many of the logistical challenges mentioned above and become an especially important source of support for emerging companies. Indeed, these six missions' sense of purpose and common goals fuel these engaging professional connections, allowing for the movement's expansion. When speaking about the circular food economy and its social relationships, the representative of C5 said:

> This concept is based on relationships. In a linear model, it's so easy for an importer or distributor to tell people at the bottom of the chain to throw food away. It's very fast and easy, and it doesn't require any other interaction, but it costs money [C5, November 15, 2023].

The representative of C6 further explained that distributors must allocate a composting or waste handling fee in their budgets, which inevitably makes them lose money on produce they do not sell. When asked about this practice, she added:

> If you can present it in a way where you show there's monetary value to the project […] and show up and say 'Hey, I want to buy [produce] from you, so not only are you going to stop paying this fee, in fact, you're going to turn it into profit because I want to come and purchase them from you', it's a no-brainer [C6, November 17, 2023].

Thus, because companies frame such partnerships as mutually beneficial and monetarily viable, distributors become more open to such initiatives. In fact, she pointed out that distributors are becoming more transparent with the amount of waste they produce and that their waste reports

are now accessible to smaller industry stakeholders such as herself. When talking about her company's debut in collecting surpluses, she recalled:

> It was this weird secret. Nobody wanted to talk about it because it just seems so bad to be throwing away all that stuff, but we do see now that people are much more transparent about it because they do see that there's opportunities to find ways to prevent it and make money from it [C6, November 17, 2023].

From these discussions, it becomes clear that not only are supplies more readily available, as distributors now understand their surpluses' profitability, but that such bottom-up initiatives can also foster a real shift in attitude from industry stakeholders who are responsible for a large part of food waste.

Interviewees also noted a real opportunity in terms of the expanding market on which upcycled foods are sold. Indeed, people are increasingly open to the upcycled foods market, principally consumers who wish to adopt a healthy, sustainable, and local diet. As previously mentioned, all companies prided themselves in offering healthier snacks and alternatives to generic foods, a fact on which they base a substantial amount of their marketing. Many consumers are also more open to sustainable eating, as part of their political stance to reduce their carbon footprint and food waste. As she observed when talking about food waste: 'People are waking up to this, there's been an enormous growth in my eyes". Finally, all companies use the 'Aliments du Québec' logo as part of their marketing strategy, as the local foods movement is particularly prominent in the province. Thus, by tapping into these three distinct but complementary markets, upcycled foods seem to gain momentum, a fact evidenced by the interviewees' explanations on consumers' shifting social acceptability for such products.

6.4: Chapter conclusions

In this chapter, I first identified the self-reported challenges of participating companies. These difficulties included social acceptability, supply inconsistencies, and output capacity. Then, I discussed both the technical and social coping strategies used by the companies to counter these challenges. The main identified technical strategies were those of marketing and branding, preservation methods to increase supply shelf-life, and narrowing the scope of the company's mission by salvaging only one main ingredient. Social strategies, on the other hand, were illustrated using a social network graph, which showcased the various partnerships between upcycled food companies and with other private and non-profit industry stakeholders who

facilitated these operations. Finally, I identified these partnerships, along with the industry's profitability and its expanding market, as opportunities for companies wishing to partake in such ventures.

CHAPTER 7: DISCUSSION & CONCLUSIONS

In the previous chapters, I shared the results arising from my interviews using commodity chain and social network analysis. In this final chapter, I synthesize my findings and reflect on the upcycled food industry's trends, coping strategies and opportunities for growth. In section 7.1, I discuss how upcycled food companies help reframe the negative discourse around food waste by emphasizing its profitability. In the following section, I highlight how upcycled food companies capitalize on unique market niches to generate a demand for their products. In section 7.3, I revisit how the industry's social and professional ties represent a crucial support system for companies operating in that sphere, showing how private and non-profit partnerships help such initiatives flourish. In section 7.4, I consider future avenues for research.

7.1: Restructuring the discourse around food waste

While 'novel' use companies do upcycle byproducts that are considered industry discards, 'alternative' use ones are reshaping conceptions of food waste and the food system's supply. I was surprised to find how often these companies had to correct my interview questions surrounding their input materials. Indeed, prior to my research, I did not know that most food upcycling initiatives in the province were 'alternative' use ones, and that they transformed agricultural surpluses, not industry waste. These companies' relationship with food waste is thus to avoid it, not use it as an input material. This distinction is necessary and crucial in public discourse, as it may avoid any confusions around the emerging products' supply safety, as these foods are not 'rotten' or of sub-par quality, they merely cannot be sold on the market due to a lack of demand.

In fact, these companies are not only redefining what food waste is, they are also changing the industry's conception of it. Indeed, by demonstrating to private stakeholders that transforming this unregulated externality is profitable, food upcycling companies are changing conceptions of what a supply in the food chain ought to be (Binder & Belz, 2015; Cohen & Winn, 2007). It thus becomes clear that these surpluses are not just the agri-food sector's burden anymore, they have become an opportunity for sustainable entrepreneurship and a locus for environmental and food innovation. In Québec's context specifically, this shift has been accelerated by venture capitalist groups' investment in the province's circular economy, a climate

ripened by the creation of green funds and the Legault administration's lack of oversight on food waste matters, fostering creativity in waste management.

7.2: A growing market

Because of this lack of governmental guidelines over the upcycled food industry, companies have managed to fill niches in the sustainable agri-food market. Indeed, as there is a small number of companies operating in this field, there are few competitors with similar missions and products, providing them with a clear marketing advantage. While their mission might set them apart from generic agri-food producers, their functions within the upcycled foods industry allow them to fill distinctly specialized niches. In the case of 'novel' use upcycled foods, input materials originate from byproducts collected at the processing stage of the food chain, representing a management solution for locally generated environmental externalities. 'Alternative' use upcycled foods, on the other hand, emerge as a response to both local and global supply management inefficiencies, offering a solution to a wide-reaching systemic issue. Thus, both categories of upcycled food companies can be understood as attempts to mediate environmental externalities at various stages of the food chain, depending on their embeddedness in global systems.

These specialized niches therefore complement consumers' growing demand for sustainable, local, and healthy foods. With the rise in politicized diets in the Global North, food no longer just means sustenance, but rather a radical stance against extractive modes of production (Chuck et al., 2016). Upcycled foods thus respond to these worries in two ways. Namely, they divert food waste, an otherwise harmful externality to the environment, and they provide an alternative framework for linear food production, directly targeting a systemic issue. Furthermore, by using the province's 'Aliments du Québec' local foods certification, upcycled foods are not only considered more sustainable, but they are also given healthful qualities, furthering their appeal. Thus, this growing demand for upcycled foods stems from a market that is increasingly aware of its carbon footprint and wishes to discover new ways to consume sustainable healthy foods (Chuck et al., 2016; Brunin et al., 2022; Marty et al., 2022; Tobler et al., 2011).

7.3: Strength is in the numbers

One of the key observations I made throughout the course of my research was the companies' resilience and adaptability to challenges arising from both operating within the biofood sector and diverting waste. Partnerships and collaboration across multiple scales were considered critical in acquiring the knowledge and skills necessary to cope with such difficulties, especially for nascent businesses. What was noteworthy about these partnerships was their multiscalar nature (Schreiber et al., 2023). Indeed, relationships within the upcycled food social web are with both private and non-profit actors. Private partnerships allow for mutual growth in times of prosperity and advice in the face of uncertainties, while the non-profit sector facilitates such activities and promotes food upcycling to wider audiences. These private and non-profit relationships are omnipresent within the companies' activities, showing a certain hybridity in their corporate structure, representing a unique characteristic of sustainable and mission-driven entrepreneurship (Binder & Belz, 2015; Kircherr et al., 2017). These collaborations are thus necessary to help mainstream the movement and make it flourish, creating more such business opportunities.

7.4: Future avenues for research

In this thesis, I focused solely on Thorsen et al.'s (2024) measure of economic viability in assessing upcycled foods' sustainability. However, future research could look at the authors' two other sustainability pillars, namely those of environmental friendliness and social equity, to assess a more comprehensive profile of the industry's durability. Such studies on environmental friendliness could include, for instance, a life cycle assessment of a specific product, or a quantification of the amount of waste and emissions diverted through these initiatives.

On the other hand, social equity studies could critically analyze the accessibility of these products across geographical and socio-economic scales. Indeed, these products are mostly available in large urban areas, as they represent the province's biggest markets. The pricy research and development processes involved in manufacturing them also places them at a price premium, which renders them even more inaccessible to some consumers. Thus, analyzing these issues could help shed light on the inequities engendered by eco-consumerism (Boccia & Sarno, 2019; Calderon-Monge et al., 2021; Lerro et al., 2019; Moshtaghian et al., 2017).

7.5: Thesis conclusions

Food upcycling companies represent a unique and innovative way to divert food waste from landfills and subsequently reduce greenhouse gas emissions. Indeed, such initiatives respond to both local and global externalities, depending on their embeddedness in the global food system. While the industry is quickly changing and expanding as part of a local, sustainable, and healthy diet, entrepreneurs are still faced with serious challenges surrounding supply consistency and scalable production volumes, which hinder their economic growth. Behavioral adaptations to these uncertainties are necessary, and partnerships with other companies and the non-profit sector remain crucial in mitigating these difficulties, especially in the early stages of development. Despite these challenges, interviewees depicted a hopeful picture of the industry, stating that the redefinition of food waste diversion as both profitable and innovative was key to building long-lasting partnerships with distributors. While my exploratory study sought to draw a preliminary profile of this emerging industry in the province of Québec, its environmental sustainability and embeddedness in food politics have yet to garner scholarly attention for a more critical assessment of its overall sustainability.

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APPENDIX A: REB Approval

McGill University
Research Ethics Board Office
www.mcgill.ca/research/research/compliance/human

CERTIFICATE OF ETHICS APPROVAL

REB File Number:	23-09-039
Project Title:	The commoditization of upcycled food waste: A case study in the Province of Quebec
Faculty Principal Investigator:	Graham Kyle MacDonald
Department:	Geography
Sponsor/Funding Agency (if applicable):	
Research Team (if applicable):	

Name	Affiliation
Erika Szabo	B.A. Honours student in Geography, McGill University

Approval Period:	
FROM	**TO**
06-Oct-2023	05-Oct-2024

The *REB-1* reviewed and approved this project by Delegated review in accordance with the requirements of the McGill University Policy on the Ethical Conduct of Research Involving Human Participants and the Tri-Council Policy Statement: Ethical Conduct For Research Involving Humans.

* Approval is granted only for the research and purposes described.
* The PI must inform the REB if there is a termination or interruption of their affiliation with the University. The McGill REB approval is no longer valid once the PI is no longer a student or employee.
* An **Amendment** form must be used to submit any proposed modifications to the approved research. Modifications to the approved research must be reviewed and approved by the REB before they can be implemented. Changes to funding or adding new funding to a previously unfunded study must be submitted as an Amendment.
* A **Continuing Review** form must be submitted before the above expiry date. Research cannot be conducted without a current ethics approval. Submit 2-3 weeks ahead of the expiry date.
A total of 5 renewals are permitted after which time a new application will need to be submitted.
* A **Termination** form must be submitted to inform the REB when a project has been completed or terminated.
* A **Reportable New Information** form must be submitted to report any unanticipated issues that may increase the risk level to participants or that may have other ethical implications or to report any protocol deviations that did not receive prior REB approval.
* The REB must be promptly notified of any new information that may affect the welfare or consent of participants.
* The REB must be notified of any suspension or cancellation imposed by a funding agency or regulatory body that is related to this study.
* The REB must be notified of any findings that may have ethical implications or may affect the decision of the REB.

APPENDIX B: Interview Guide

- How would you describe your company's mission (around the beneficial upcycling of food waste)?
- Can you tell me about the kind of products your company currently manufactures and how it came to do so? That is, the company's origin story…
- What is the nature of food waste involved in this? Where do you receive the food waste from?
- If you consider the full life cycle of your product, does your company work with any other individuals or organizations during your transformation process? (For example, restaurants, food processors, non-profits, government agencies?)
    - Part of my research focuses on the role of social relationships and networks in upcycling food waste. Is there anything particular to your company or experience I should know about this?
- Can you briefly describe the production process to get a product from this initial food waste to the final end-product? For example, what are the key steps needed to get your product to market?
- Do you do all the processing in one facility? If not, can you briefly describe the other facilities involved?
- What do your transportation logistics look like? Do you use your own company for transportation or an intermediary?
- How are your products marketed? (e.g., retail stores, online, wholesale, etc.) In which cities or locations?
- On average, how many kilos of food waste does your company handle in a typical month? Do you know what would happen to the food waste if your company did not capture it?
- What are some challenges or barriers your company has encountered in your journey so far? (Anything from production to manufacturing…) Do you think this is changing as the industry grows?
- Is there anyone else you'd recommend I talk to at your company or in general about this sector in Quebec?

(Source: Author; Dr. Graham MacDonald)

APPENDIX C: Company Characteristics

Company	Product	Supplier(s)	Points of Sale
C1	Crackers	Breweries	Chain Grocery Stores; Small Grocery Stores; Food Basket Delivery System; Online
C2	Fruit Snack	Grocers, Food Processors	Small Grocery Stores; Food Basket Delivery System; Online
C3	Meals	Local Producers	Small Grocery Stores; Food Basket Delivery System; Online
C4	Drinks	Local Producers, Distributors	Chain Grocery Stores; Food Basket Delivery System; Online
C5	Drinks	Distributors	Chain Grocery Stores; Small Grocery Stores; Food Basket Delivery System; Online
C6	Fermented Foods	Local Producers, Distributors	Chain Grocery Stores; Small Grocery Stores; Food Basket Delivery System; Online

(Source: Author)

APPENDIX D: Breakdown of Edible Food Waste per Process Along the Chain

(Source: Recyc-Québec, 2022)

APPENDIX E: Socio-matrix of Upcycled Food Companies

	C1	C2	C3	C4	C5	C6
C1	-	0	0	0	0	0
C2	0	-	1	0	0	0
C3	0	1	-	0	0	0
C4	0	0	0	-	1	1
C5	0	0	0	1	-	0
C6	0	0	0	1	0	-
Total	0	1	1	2	1	1

(Source: Author)