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Challenges in Adopting a Circular Economy model in Born-Sustainable Micro and Small Enterprises - study on Food-Tech sector in Sweden

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AUTHOR

ALEJANDRA FERNANDEZ CASTANEDA

SUPERVISOR

SOLOMON AKELE ABEBE

EXAMINER

JOHANNES GARTNER

ABSTRACT

The agri-food system has driven economic development and supported the growing population, but it has also significantly contributed to greenhouse gas emissions. Moreover, the system is vulnerable and faces challenges that hinder innovation and sustainability. Transitioning from a linear to a circular economy model in the food system can effectively restore biodiversity, combat climate change, and promote the development of healthy cities. However, this transition poses challenges especially for small enterprises. This thesis examines the challenges associated with adopting circular economy strategies in born-sustainable micro and small-sized enterprises in the food-tech sector in Sweden. It is based on qualitative research with empirical evidence from 11 diverse enterprises, including producers of food, beverages, supplements, and edible packaging in Sweden. The results highlight the five critical dimensions as challenges to transitioning to a circular economy, including customer behaviour, raw material sourcing, supply chain, technology-innovation, and legislation. An explanatory framework model was developed to illustrate the potential adoption of a circular economy model in the agri-food system, aiming to promote sustainable supply chains, regenerative food sourcing, local prioritization, healthier product design, and production in Sweden. Policy interventions and collaboration in the food-tech sector can further accelerate the adoption of circular economy practices. However, additional research is needed to understand the perspectives of key stakeholders such as farmers, distributors, and consumers.

Keywords: Agri-food system; Circular economy; Sustainability; Food-tech; Circular food system; Food-tech ecosystem; Sweden.

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LIST OF ACRONYMS

BM	Business Model
CE	Circular Economy
CEAP	Circular Economy Action Plan
LCA	Life Cycle Assessment
SBA	Small Business Act For Europe
SFS	Sustainable Food System
MSEs	Micro And Small-Sized Enterprises
SRQs	Specific Research Questions

Table of Contents

1. INTRODUCTION

In this chapter, the global impact of food system is analyzed based on the current linear economy model "take-make-dispose", while some entrepreneurs choose to operate in a better way. The chapter explains the gap in the challenges faced by food-tech Enterprises in Sweden that try to adopt circular economy practices.

1.1. Background

Food production has significant environmental impacts, including eutrophication, loss of biodiversity and increased CO_2 emissions. These issues are increasingly sustainability concerns in current food production practices (FAO, 2021). This has forced governments, industries, and new enterprises to prioritize actions that significantly reduce environmental degradation. One solution gaining attention is the circular economy (CE), which has its roots in industrial ecology and environmental sustainability theories (Liu, Adams, & Walker, 2018). The CE challenges the traditional linear economic growth model that assumes an endless supply of resources (Geissdoerfer et al. 2017). Some scholars, policymakers, and entrepreneurs are developing a new economic model that reintroduces resources and energy from discarded products into the financial system (The Ellen MacArthur Foundation, 2012).

Entrepreneurship scholars are increasingly focusing on CE due to its significant role in the sustainability paradigm and especially in the potential of circular food economy. Previous studies have examined factors such as influencing CE decisions process (Lugo, Kimita & Nishino, 2023), managerial practices and strategies (Yin et al. 2023; Pakseresht et al. 2022), tools and models (Correani et al. 2023; Paparella et al. 2023), and social entrepreneurship (Dantas et al. 2021; Zucchella & Previtali, 2019). Nonetheless, it is imperative to research the obstacles associated with implementing the CE approach, particularly for each industry and sector of the economy, given the considerable differences and ramifications contingent upon them (Rajput & Singh, 2019). Scholars acknowledge that the CE is a multifaceted process, necessitating a comprehension of the complete value chain (Rizos et al. 2016).

The food and beverage industry has been identified as a major contributor to global greenhouse gas emissions, accounting for over 26% of total emissions. Food production and distribution also consume vast amounts of natural resources, further exacerbating the problem (FAO, 2021). This underscores the urgent need for innovative food-tech business models and sustainable food production methods to mitigate the adverse impacts of climate change (Rizos et al. 2016).

This study intents to provide an integrative understanding of the challenges associated with implementing CE principles at different stages of the food-tech value chain. Therefore, a more sustainable economic model that promotes the reuse and recycling of resources while reducing waste is essential (Govindan & Hasanagic, 2018). The CE offers a promising solution by integrating sustainability principles into entrepreneurship and paving the way for a more sustainable future (Rajput & Singh, 2019).

Transitioning to a CE is essential to shift away from the linear "take, make, waste" model and promote sustainable production and consumption practices. CE principles can also lead to financial benefits, as seen in a Nordic Innovation report (2021) estimating up to $140 billion in savings by 2030. To achieve these goals, industries with significant impacts on the economy, environment, and social progress, such as the food and beverage sector, must gather and disseminate data to develop more efficient resource utilization practices (The Ellen MacArthur Foundation, 2012). In this regard, the CE presents a fresh alternative to optimize the material flow, curtail CO_2 emissions, and reorient economic models of production and consumption towards sustainability (Kalmykova, Sadagopan, & Rosado, 2018).

To accomplish this objective, it is vital to scrutinize, systematize, and disseminate data across industries that have a significant impact on the economy, environment, and social progress, such as the food and beverage Industry. This approach can facilitate the development of new perspectives and practices for the proficient utilization of resources (Jurgilevich et al. 2016).

Although positive growth in sustainable business models has been observed in Sweden's food-tech industry (Vinnova, 2022), there is a dearth of research on the challenges encountered by micro and small enterprises (MSEs) in transitioning to CE models. Specifically, there is no evidence to date on the challenges faced by born-sustainable MSEs in this sector in Sweden. For instance, Haller et al. (2022) have conducted case studies on the opportunities and challenges of local food production and industrial symbiosis in Härnösand, they did not examine any food MSEs that could be possible involve. However, some scholars have studied the challenges on implementing CE in the food supply chains on emerging economies, such as India, the key impediments identified are poor government policies, lack of technology and infrastructure, and insufficient CE knowledge among employees (Y. Sharma et al. 2019; N. Sharma et al. 2021; Kumar et al. 2022). However, these factors may not be directly applicable to the Swedish context. Therefore, further research is needed to understand the unique challenges faced by MSEs in the food-tech sector when transitioning to CE models in Sweden.

In this context, this research tries to fill the gap by using an explorative inductive methodology based on evidence from food-tech and MSEs in Sweden. Therefore, this research will try to complement the existing literature in the field of CE, a strategy towards sustainability applied to the food and beverage sector for a better health and sustainable future.

Therefore, given the importance of the food/beverages sector in contributing to CE and the lack of research around the challenges that the born-sustainable MSEs encounter, this study aims to address this suggested research area, specifically in the context of MSEs in Sweden. The research question formulated is "What challenges are facing born-sustainable Food-Tech MSEs in transitioning to circular economy practices in Sweden, and how does their sustainable business model support this transition?"

1.2. Aim and research questions

Given the above discussion, the overriding aim of the study is to provide a comprehensive understanding of the challenges the born-sustainable food-tech MSEs in Sweden encounter in their business journeys towards their circular economy adoption model. Realizing this aim involves comprehensive exploration of the CE challenges at the different levels of the value chain. Therefore, the main research question guiding this study is: What are the challenges facing MSEs to transition into a full CE model. The insights obtained from this study are presented as an explanatory framework depicting the CE challenges at the different levels of value chain in the food sector and the possible transition strategies.

To capture the aforementioned aim and research question, the following specific research questions (SRQs) guide this study:

> ***SRQ1.*** What are the challenges facing by Swedish born-sustainable food-tech MSE´s encounter when adopting a circular economy model for sustainability to transition into a full CE model?
> ***SRQ2.*** How can the challenges and transition strategies to circular economy model be synthetized into an explanatory framework?

1.3. Significance of the study

The CE concept in entrepreneurship has emerged as a promising solution to several challenges faced by traditional linear economic models, which rely on a "take, make, waste" approach

(Genovese et al. 2017). CE is a comprehensive approach to sustainability and efficiency that helps organizations optimize resources, increase reuse and recycling practices, together with promote ethical and socially responsible business practices (Vinnova, 2022). On this basis, developing circularity in the food industry can significantly contribute to lowering the impact of climate change while ensuring a sufficient food supply for future generations.

In Sweden, micro, small and medium-sized enterprises are increasingly embracing this objective to follow a circularity approach, with over 50% of venture capital investment in 2021 is directed towards companies that align with at least one of the United Nations' Sustainable Development Goals (SDGs), according to a report by Vinnova (2022). Despite the challenges of adopting a CE business model in the new venture creation, many entrepreneurs embrace the CE to create more sustainable and profitable businesses.

A key priority of CE is reducing, reusing, and recycling resources while minimizing waste and using finite resources, thereby promoting more sustainable and resilient businesses (Suchek, Ferreira & Fernandes, 2022). Evidence suggests that entrepreneurs who adopt circular practices can benefit from cost savings, increased resource efficiency, and reduced environmental impacts (Suchek, Ferreira & Fernandes, 2022). In summary, CE presents a promising framework for businesses to tackle sustainability challenges while simultaneously fostering economic growth and social responsibility.

Furthermore, CE can provide new business opportunities by developing innovative products and services that support a more sustainable future. Indeed, the objective of circularity is to close the linear models, which improves and reduces the use of natural resources, obtaining a more environmentally friendly process and focusing on sustainable growth (Genovese et al. 2017). In the study of the concept of circularity, certain principles have emerged, such as the 3Rs that refer to Reduce, Reuse and Recycle, which have currently been extended to include others such as Remanufacturing or/and recover; these create added value to what is considered as waste (Genovese et al. 2017).

1.4. Food-tech MSEs: The gap of CE in born-sustainable MSEs

Plant-based and healthy food and beverage products are often perceived as more environmentally friendly because they emit lower levels of GHG than traditional and animal-based food production; as a result, they are sustainable (Potter & Röös, 2021). Several existing

Food-tech MSEs in Sweden have started adopting some CE principles. However, even the born-sustainable MSEs still have a particular impact on the environment. To further reduce their impact, it is crucial to continually improve their entire supply chain and aim for a CE model (Vanhuyse et al. 2022).

The study by Suchek, Ferreira and Fernandes (2022) identify that more than half of the studies reviewed focus on growing circular MSEs, and only a few of the studies focus on the born-sustainable MSEs. Furthermore, previous studies on born-sustainable MSEs are developed in a fragmented way, and there is still much to be studied of born-sustainable MSEs (Suchek, Ferreira & Fernandes, 2022; Velenturf & Purnell, 2021).

In this respect, there is a gap in the research areas for the born-sustainable MSEs in recognising the challenges encountered in developing a circular business model from scratch. In fact, part of the challenges of the born-sustainable MSEs are diverse including technical, political, regulatory, economic, and cultural spheres, and they must be overcome (Winans, Kendall & Deng 2017).

1.5. Scope of the study

This research ambitions are to analyse and synthesize the current knowledge and challenges about the CE performance/adoption in food-tech MSEs in Sweden that have based their value proposition on a sustainable business model, with a focus on how this can support a successful transition to CE discovering the main challenges to be faced by the entrepreneurs. Overall, the aim is to identify the challenges, key actors and contextual factors involved in the business model and their interactions that contribute to the CE's success as a sustainability tool. There are different levels of challenges that these MSEs could face, including but not limited to the following Business Model, Financial, and Internal structure of the organization, Market, Operations: Energy and resources, Supply chain, and Waste management. Finally, the research will try to fill some gaps in the current knowledge that require further investigation to support the transition to a more CE in the food and beverage enterprises as innovation and more sustainable products.

This thesis adopts a qualitative methodology with an inductive approach. The study involved conducting eleven semi-structured interviews and deep possibly faced the challenges of the business model for each MSEs participant. However, the aim is to try to find typical patterns

and sharing characteristics. The main focus of the research is to develop a conceptual framework based on the perceptions of food-tech MSEs as a phenomenon and the CE towards sustainability as a context.

1.6. Disposition of the thesis

The thesis is organized into six chapters. First part provides background information on the study. Second part presents the conceptual framework, outlining the potential benefits of adopting CE models for new companies while acknowledging the barriers and challenges that must be explored by the literature. Third part explains the methodology used in the study, which was based on a qualitative and inductive approach. Forth part presents the main findings, revealing the challenges that impede food-tech MSEs in Sweden from transitioning to CE models. These challenges include consumer acceptance, legal ambiguity, and limited access to raw materials, supply chain complexity, and technological innovation. Fifth part discusses these findings in relation to existing literature, and sixth part provides conclusions and implications for researchers and policymakers.

2. THEORETICAL FRAMEWORK

This chapter presents a summarized theoretical framework of closed-loop systems in the food and beverage industry's circular economy, aiming to understand the foundation of circular economy approaches for sustainable business models.

2.1. Circular economy: definition

Despite being a current global trend, the idea of creating sustainable business models using circularity strategies has been around since the 1970s (Geissdoerfer et al. 2017). Pearce and Turner first introduced the theory of CE in 1989. Initially, the concept focused on using natural resources efficiently for production and utilizing waste from manufacturing (Geissdoerfer et al. 2017). In the early 1990s, Ayres (1994) explained that the industry operates by transforming raw materials and energy with human labour into a final product, producing waste in the process, as result the goal should be to reach a steady-state condition where there is a closed-loop of material flow within the system (Bocken et al. 2016). Figure 2.1 below illustrates the continuous flow of resources that summarizes very well the foundation of CE (FAO, 2021).

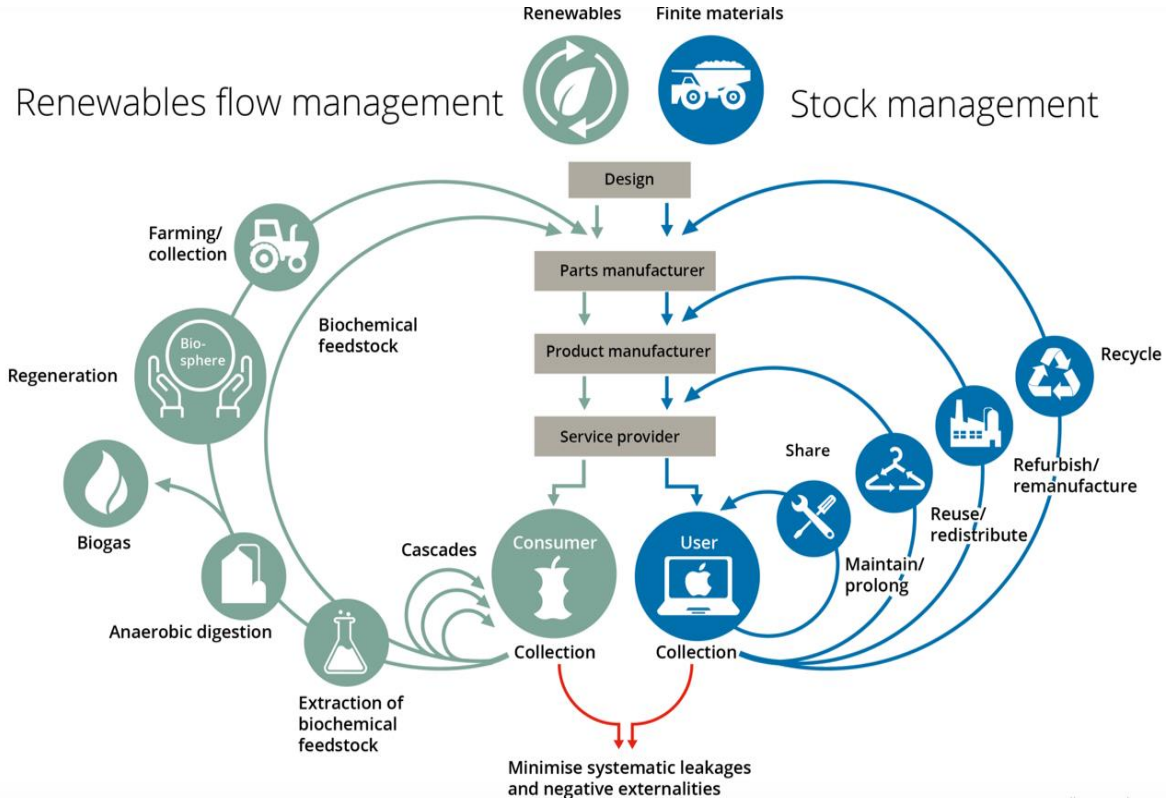


Figure 2.1 Butterfly diagram: Outline of a circular economy
Source: FAO, 2021 Circular economy – Strategy for the transition in Sweden

Today, the approach has become more comprehensive, incorporating a closed-loop economy methodology that prioritizes waste prevention, regional job creation, resource efficiency, and decreasing material usage in the industrial sector (Suchek, Ferreira & Fernandes, 2022). Furthermore, the ecology law, ecology and regenerative industrial and blue economics have shaped the CE concept and it can be applied to supply chain, circular business models, and circular product design (Bocken et al. 2016).

Evidence has demonstrated that the combination of CE and technological advancements can effectively decrease waste and optimize the usage of natural resources, as well as enhance product efficiency and environmental health (Kirchherr, Reike & Hekkert, 2017). The CE's "reduce, reuse, and recycle" philosophy offers both social and economic benefits and can alleviate environmental concerns (Khajuria, 2020). However, the shift towards circularity is not happening at a fast enough pace, thus, necessitating the implementation of more efficient policy measures (Bocken et al. 2016). As a result, there is an increasing demand to adopt CE business models that are designed to move away from the traditional linear model of production. The next section discusses the CE business model in more detail.

2.2. Circular Economy Business Model

The CE differs from the traditional linear model of production and an industrial system heavily reliant on fossil fuels. CE business models aim to generate profits from the flow of materials and products over time instead of solely from selling products. This shift enables economically feasible ways to continuously reuse products and materials, utilizing renewable resources whenever possible (Bocken et al. 2016).

Transitioning from the current linear economic model to a circular one can result in significant financial savings and reduce negative environmental impacts. This is why the concept of the CE has gained increased attention as a powerful and recent approach towards sustainability (Lewandowski, 2016). The switch to a CE model necessitates a significant change and a new way of conducting business. Implementing the concept in the early stages of business model creation plays a crucial role (Bocken et al. 2016).

Implementing CE strategies in business models requires key elements to ensure a successful transition. According to Bocken et al. (2016), some successful business models offered value propositions from a circularity perspective, one of which is the provision of products/services

without ownership of physical products, such as car sharing and “leasing of jeans”. Another strategy is to maximize the residual value and extend the life of products, such as remanufacturing parts from reusable and recycled materials. Some businesses aim to offer long-life models and repair services. Some businesses focus on industrial symbiosis, where one process serves as a feedstock for another process, usually requiring geographical proximity among businesses, this is exemplified by the Kalundborg Eco-Industrial Park in Denmark, which generates profits through a circular approach to production (Bocken et al. 2016).

On the one hand, adopting circular models towards sustainability can create value for new companies. The potential benefits include operational cost reduction, positive brand image positioning, and potential revenue increase. Additionally, adopting CE models has significantly reduced the risk of initial investment (Nordic Innovation, 2021). However, barriers to adoption exist and must be explored in detail in the literature, particularly as each sector and/or industry faces unique challenges related to value propositions, legislation and policies, technical and technological aspects, as well as cultural and knowledge barriers in society and the potential market (Kalmykova, Sadagopan & Rosado, 2018).

A deeper exploration of the theoretical aspects of the challenges to implementing CE models, particularly in new MSEs, is essential to promote their application and accelerate the global transition to circularity. Furthermore, such an exploration can influence the ecosystem towards creating new ventures with a CE approach towards sustainability (Kalmykova, Sadagopan & Rosado, 2018).

2.3. Relationship between Circular Economy and Entrepreneurship

Entrepreneurship is the process of identifying and pursuing new opportunities by accepting risk and uncertainty. Entrepreneurs have the potential to drive innovation and create new products, new methods of production, new sources of raw materials, and new forms of organizations (Suchek, Ferreira & Fernandes, 2022). In relation to environmental sustainability, entrepreneurial activities may offset market failures and lead to the more efficient utilization of natural resources, thereby contributing to the development of an ecologically sustainable economy (Lewandowski, 2016). Entrepreneurs can play a role in advocating for institutional changes that promote sustainable practices and improve the competitiveness of sustainable behaviours, paving the way for new entrepreneurial attitudes (Lewandowski, 2016).

The concept of circular entrepreneurship could define a type of sustainable entrepreneurship that seeks to identify opportunities within the CE to promote environmental and social sustainability. It concerns protecting people and the environment while generating economic value. This type of entrepreneurship overlaps with other forms of sustainable entrepreneurship as organic, green, and blue entrepreneurship, which respectively focus on promoting human health, mitigating climate change, and preserving aquatic ecosystems (Suchek, Ferreira & Fernandes, 2022).

Lately, some companies are referred to as "born-sustainable", often being young ventures that prioritize the values of the CE in their operations and product offerings. These companies align their business practices with the SDGs and position themselves in the market as environmentally conscious (Suchek, Ferreira & Fernandes, 2022. Re & Magnani, 2022). Meanwhile, established companies, particularly in MSEs, are exploring opportunities to adopt the CE framework to improve their reputation, reduce manufacturing costs, increase financial profitability, and attract investment (Re & Magnani, 2022). The academic literature has emphasized the implementation of the CE in MSEs, outlining the key steps involved in the "reduce, reuse, recycle, and recover" cycle, the importance of inter-company symbiosis, and the value of certifications for marketing purposes (Re & Magnani, 2022).

2.4. Process of implementation of the Circular Economy into the business model in MSEs

CE business models require cooperation with stakeholders who spotlight sustainability and have the necessary expertise to close resource loops efficiently; Figure 2.2 below provides a comprehensive visual representation (Re & Magnani, 2022). The literature compiles that CE implementation in MSEs shows three factors associated with their perception: “material provision, resources reutilization, and financial advantages” (Suchek, Ferreira & Fernandes, 2022). Studies in Europe indicate that sourcing, end-use, and design are the most relevant CE practices in MSEs, with higher maturity in distribution and production.

The complexity of the implementation of CE seems to affect every part of the functionality of the business model; for this reason, it is necessary to understand the context and the challenges faced in Sweden for the food-tech MSEs that are training to implement CE principles in their goal to aim sustainability.

Waste management, renewable energy, and eco-design are widely implemented, but resource-saving practices are less common. Ultimately, the level of CE implementation in MSEs depends on factors such as the size, revenue, R&D investment, and available resources of the companies (Suchek, Ferreira & Fernandes, 2022).

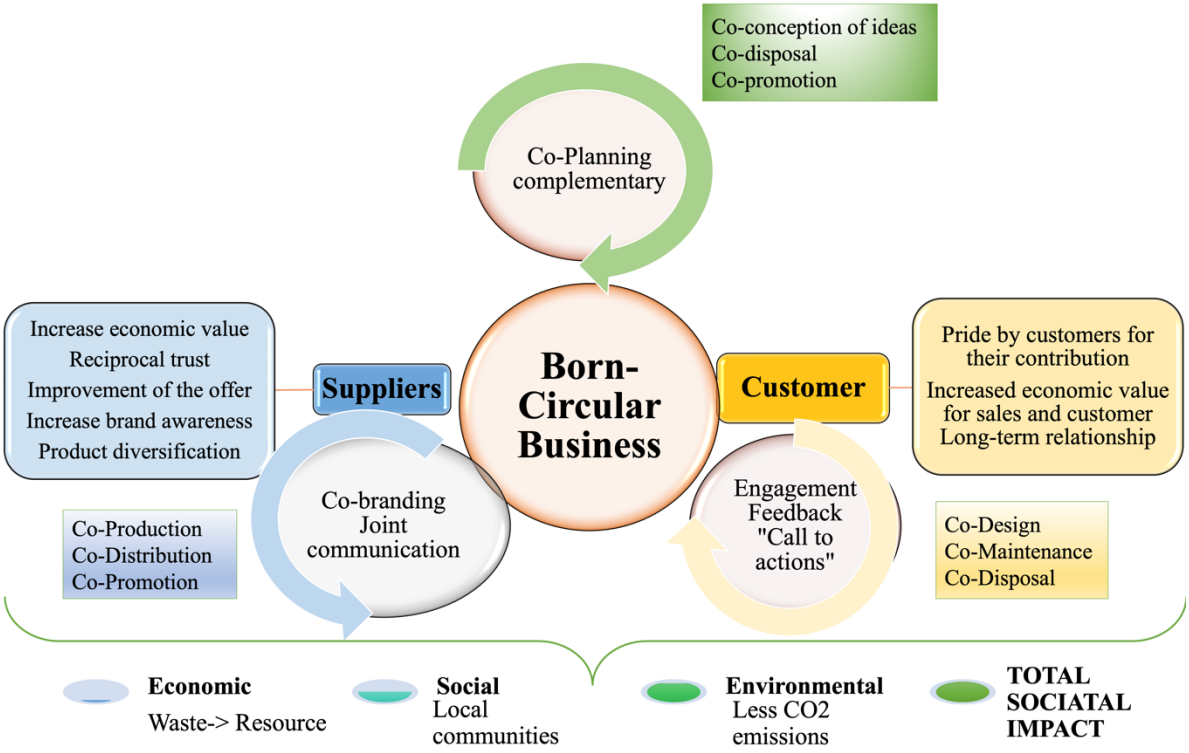


Figure 2.2 Empirical model of business model in circular entrepreneurship
Source: Re and Magnani, (2022) with modifications by author

However, several studies have been dedicated to explaining the opportunities as well as the challenge that "born-sustainable" firms and SEMs toward CE already face, which can range from the specific design of the strategies, part of the customer education due the novelty of the product/service and the value alignment with the entire supply chain (Re & Magnani, 2022).

2.5. Strategies in the implementation of the CE model in MSEs

Some activities are used by enterprises to adjust their production models and optimize resources. These activities can be from the use of wasted materials, the management and disposal of waste, energy re-use, innovation of processing technologies, eco-packaging materials, supplier contact and digitization, among many other areas (Kalmykova, Sadagopan & Rosado, 2018). The use of the constructed CE strategies database is exposed, which aims to

summarize the CE implementation methods shows in the systematic literature study by Kalmykova, Sadagopan and Rosado (2018) observed in Table 2.1

Table 2.1 Implementation tools from a review of theories and practices of CE

Material Sourcing
• Cross-sector linkages: Promotion of collaboration among industries. • Energy production and autonomy: From by-products, residual, waste and so on. • Green procurement: Public authorities choose to procure goods and services with lower environmental impact. • Life cycle assessment (LCA): Standardize method quantifies the emissions. • Taxation and subsidies: For the negative impact and motivating the use of bio-based materials, for example, respectively.
Manufacture
• Energy efficiency: Requires the use of modern technologies and greater investment. • Material productivity: Increase the yield of material input and consumption. • Reproducible and adaptable manufacturing: Transparent, scalable production, technological processes and sharing knowledge to be applied in other places or countries.
Distribution and Sales
• Optimize packaging design: Reduction of food waste and loss. Regulate the post-handling of packaging. • Redistribution and resell: Reselling as a second-hand is applicable in some industries.
Use and Consumption
• Communication: Sharing platforms with guides for the repair and reuse of products. • Eco and product labelling: Environmental certification. Impartial labelling by public or private third parties. the origin of raw materials, fair-trade and so on. • Circular inputs: Bio-based materials, renewable and regenerated resources.
Recycling and recovery
• By-product use: Seen as raw materials to produce new products. • Downcycling: New products of lower quality or lower functionality. • Energy recovery: Convert waste into heat, electricity, or anaerobic digestion, for example. • Industrial symbiosis: Exchange of resources and by-products between nearby companies • Upcycling: New materials with higher quality.
Collection and Disposal
• Extended producer responsibility: Responsibility post-consumer stage. • Incentivized recycling: Rewarding system as deposit refund.

- Logistics: Facilities to promote cost-effective post-consumer collection and disposal.
- Separation: Biological content should be separated from the inorganic part.

Source: Kalmykova, Sadagopan and Rosado (2018) with modifications by the author

As can be inferred from the previous summary of CE implementation strategies, they can be divided into CE theory-policy (applicable at regional, local, & national levels) and focus groups (in sectors, products, industries, materials, etc). Once again, the 4Rs are highlighted as the core strategies to achieve CE (Kalmykova, Sadagopan, & Rosado, 2018).

Some authors, such as Van Opstal and Borms (2023) explained that for MSEs, it is easy to adopt CE principles while the company culture is still in the development phase, especially if the CE concept is adopted from scratch. Moreover, the start-up ecosystem has the potential to influence the current institutional model and create the necessity to shift to a CE model. However, this requires a well-managed design, including supply chain management and financial viability. Most of the current research in the start-up environment has focused on exposing the challenges that need to be encountered and investigating the pathway to success with environmental and economic goals (Van Opstal & Borms, 2023).

2.6. Challenges to the adoption of Circular Economy

Even though certain MSEs intend to adopt CE principles as the core business model, they tend to encounter challenges in meeting their CE principles. These include challenges on the market level and value chain level, such as a lack of product variety due to limited raw materials that are circular (Cullen & De Angelis, 2021). In addition, CE-focused technology, innovation process, manufacturing facilities, and value chain can be more expensive, resulting in CE-based products being more expensive from the lens of the buyers and consumers and, therefore, less attractive (Kahupi et al. 2021).

Another challenge is the funding or financing level. When the start-up looks to scale up its business, its growth and profitability may have to be sacrificed to retain sustainability values (Cullen & De Angelis, 2021). When a start-up's profitability must be compromised, this can impact the start-up's possibility of getting fundraising as investors tend to look for the highest return on their investment, given an acceptable risk level (Kahupi et al. 2021; Guldmann & Huulgaard, 2020).

2.7. Circular Economy in the food system

As previously mentioned, the food production system has a significant negative impact on the environment. In addition to CO_2 emissions and eutrophication (caused by industrial practices), there are other issues, such as food waste and losses (Jurgilevich et al. 2016). Estimates suggest that around 30% to 50% of food is wasted, leading to environmental implications such as increased methane production during decomposition and embedded greenhouse gas emissions (Jurgilevich et al. 2016). A CE approach provides a valuable tool for optimizing the food system (Jurgilevich et al. 2016). A framework, divided into three stages, illustrates in Figure 2.3 how CE concepts and principles can be implemented (Jurgilevich et al. 2016).

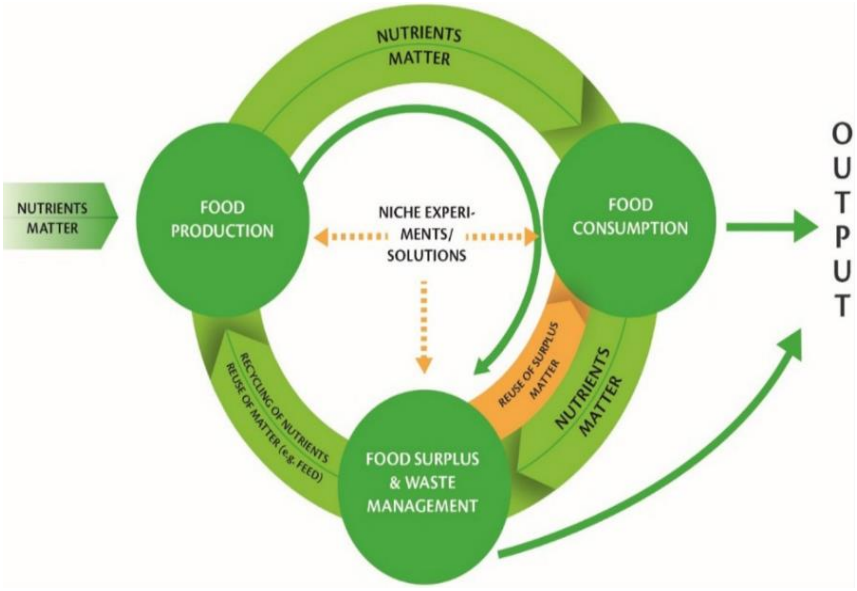


Figure 2.3 The approach aims to minimize waste and make use of byproducts and food waste. These measures should be implemented at both producer and consumer levels Source: Jurgilevich et al. (2016).

Figure 2.3 approach is practical and realistic as it acknowledges that applying CE throughout the entire supply chain can be overwhelming. Instead, it recommends focusing on one stage at a time, as each stage offers opportunities for applying CE principles (Jurgilevich et al. 2016). A CE model should be regarded as a knowledge and application tool for continuous improvement and an economic benefit that ensures continued operation.

Figure 2.3 highlights that not all nutrients can be cycled, but the food system can be subcategorized into three main streams: food production, food consumption, and food surplus and waste management (Jurgilevich et al. 2016). This method allows for an effective analysis

of the areas where CE can be applied and recognizes the challenges entrepreneurs face in implementing it.

To sum up, CE for food presents a chance for testing a novel approach from the production to the utilization of goods, with an emphasis on incorporating economic and social factors while benefiting both humanity and the environment (Fassio & Tecco, 2019). However, achieving this goal necessitates enhanced coordination and integration between stakeholders at some stages of production and consumption. The authors Fassio and Tecco (2019) proposed a shift from a circularity that prioritizes output optimization to a holistic regenerative model that aligns with nature and features multi-dimensional and systemic quality.

2.8. Sustainable food system from Circular Economy entrepreneurship practices

The sustainable food system (SFS) is an approach aimed at ensuring food security and nutrition for all while maintaining the economic, social, and environmental foundations for future generations (FAO, 2018). The CE can play a significant role in achieving this goal by creating new business opportunities and promoting innovation, leading to sustainable development. The CE represents a paradigm shift in the relationship between human society and nature, with the target of preventing resource depletion, closing energy and material cycles, and fostering sustainable development (Rosenthal et al. 2021).

The implementation of this CE system occurs across various levels, including micro (companies & consumers), meso (economic actors), and macro (cities, regions, & governments) (Suchek, Ferreira & Fernandes, 2022). Entrepreneurs and start-ups are essential to this transition as they bear the responsibility of planning for waste reduction, promoting material reuse, and increasing consumer consciousness of green products through the implementation of innovative strategies (Suchek, Ferreira & Fernandes, 2022).

Sustainability and CE are crucial for creating a better future. Both concepts are related but different; sustainability aims for long-term viability, considering economic, social, and environmental aspects, while CE aims to optimize resources through a closed-loop system. As a result, CE is a model for achieving sustainability. However, their implementation is still lacking. The current linear economic model remains prevalent, emphasizing the need for

increased research and innovation to effectively integrate CE principles, even in sustainable business models (Rosenthal et al. 2021).

2.9. To be born-sustainable MSEs: the case of Food-tech sector

Born-sustainable MSEs companies are characterized by their explicit commitment to operating in a sustainable manner. Their foundations are based on a strategic intent to provide products/services in a manner that significantly reduces negative environmental impact within a specific market. However, these companies face several challenges, including the balancing of environmental, social, and financial demands in the management of their operations (Allal-Chérif, Climent, & Berenguer, 2023).

The formation of the business model for born-sustainable MSEs necessitates exceptional external collaboration with a long-term partner. This partnership should involve a shared vision and goals, as well as advanced communication techniques to exchange knowledge, new practices, strategies, and transfer technology (Allal-Chérif, Climent, & Berenguer, 2023); These actions may pose challenges for MSEs as they strive for sustainability.

The literature agrees that sustainable entrepreneurs must implement ground-breaking strategies to achieve a significant difference in their operations in comparison to conventional businesses, as well as building strong partnerships with suppliers may be perceived as a component of the business. Some essential steps involve engaging in transparent and sustainable research, development, and production of products/services, and actively advocating for sustainable values through educating and inspiring customers and industry peers, as well as moulding the market through a competitive edge (Allal-Chérif, Climent, & Berenguer, 2023).

The growing market demand for plant-based foods and health drinks as environmentally friendly options presents a favourable opportunity for businesses. Indeed between 2022-2020, the Europe plant-based food and beverages market is expected to grow 10.1% CAGR to reach $16.7 billion by 2029 (Meticulous Research, 2021). The rising global trend of plant-based food and government support create a favourable outlook for businesses to invest (Rosenthal et al. 2021).

Plant-based products are perceived by customers as a more environmentally friendly and sustainable solution for feeding the growing population. Despite this, a thorough analysis of the supply chain shows that factors such as the agriculture process, use of pesticides,

transportation, energy use, manufacturing, and water sources can still lead to substantial greenhouse gas emissions (Xu et al. 2021). Additionally, food waste generated during production and post-production is also a concern. By adopting a CE approach, a substantial decrease in environmental impact can be achieved (Rosenthal et al. 2021). Although plant-based products are a positive step forward, there is still room for improvement.

2.10. Policy and government regarding circularity toward sustainable development

The European Commission (2020) has agreed that the transition to a CE will decrease the pressure on natural resources and promote the creation of jobs in a sustainable way, as stated in the new CE action plan (CEAP). The commission presented several proposals to make sustainable products, boost circular business models, and empower consumers for the green transition through strategies such as increasing recycling and preventing loss of valuable materials, creating jobs and economic growth. Encouraging new business models, eco-design, waste prevention and industrial symbiosis in Europe toward zero waste (European Commission, 2020).

The government Offices of Sweden released a report in 2020 outlining their strategic plan, stated *"Greater circularity and resource efficiency are necessary to reach the climate objectives"*. Regarding the food sector, the plan is promoting the increase of local food production and the improvement of the manufacturing process with the aim of reducing energy consumption. While there are various theoretical models, policies, and action plans that promote the implementation of the CE, there is a lack of clear and specific guidance in the literature or from the Swedish government on how to transition and adopt CE in the manufacturing industry. This generates difficulties for Food-tech MSEs to achieve the full potential of circularity (Wasserbaur, Sakao, & Milios, 2022).

2.11. Summarizing the literature review: Key takeaways for the study

This chapter critically examines the concept of CE, which aims to mitigate waste, emissions, and energy consumption by employing enhanced approaches to design, maintenance, repair, reuse, remanufacturing, and recycling. It underscores the paradigm shift from the conventional linear production model to CE, which centers on capitalizing on the continuous flow of materials and products to generate economic value. It also explores successful business models

that offer value propositions from a CE perspective and focuses on industrial symbiosis (Wasserbaur, Sakao, & Milios, 2022).

The analysis highlights the multifaceted challenges confronted by environmentally conscious MSEs in achieving a delicate equilibrium between environmental stewardship, social responsibility, and financial viability. The relevance of this literature review is important as it provides valuable insight into the challenges faced by food-tech MSEs in adopting CE principles, which is useful for researchers interested in food-tech entrepreneur ecosystem (Fassio & Tecco, 2019).

Furthermore, a gap exists concerning the comprehensive understanding of the challenges faced by nascent sustainable MSEs in conceiving and establishing a circular business model from its inception. These challenges encompass a broad spectrum, spanning technical, political, regulatory, economic, and cultural dimensions, all of which necessitate concerted efforts to surmount (Winans, Kendall & Deng, 2017).

3. METHODOLOGY

This chapter presents the methods of qualitative and inductive research, developing to achieve the research aim of exploring the challenges, practices, and strategies associated with circular economy adoption by sustainable food-tech MSEs in Sweden.

3.1. Research paradigm

3.1.1. Ontology and epistemology

The ontological assumption of this study is grounded in constructionism, which posits that reality is socially constructed and shaped by human experiences and interactions. Therefore, the study recognizes that the concept of CE is not an objective reality but rather a social construct that is shaped by social actors and their interactions with the environment (Bahari, 2010). The epistemological assumption is interpretative, which acknowledges that information is subjective and context-dependent. The study recognizes that the perception of food-tech MSEs towards CE principles is influenced by their subjective experiences, beliefs, and values, which are shaped by their organizational culture, industry norms, and external factors (Bell, Bryman, & Harley, 2019; Scotland, 2012).

The chosen methodology is inductive, which allows for the exploration and generation of new knowledge from the data collected rather than testing pre-existing hypotheses. The study aims to identify external challenges that impede the CE transition of food-tech MSEs and uncover insights into why MSEs perceive their actions towards the CE as less impactful based on their subjective knowledge. The study will use a qualitative approach, which allows for in-depth exploration and understanding of the lived experiences and perspectives of food-tech MSEs towards the CE.

According to Lewandowski et al. (2016) and, more recently, Corvellec, Stowell and Johansson (2021), achieving 100% circular business models may be challenging and constrained by factors such as technological, economic, and legislative aspects, depending on the context. As a result, achieving complete circularity may not be realistic due to physical and practical limitations. However, CE can be understood as a new way of thinking about how we can grow without solely relying on the consumption of resources.

Therefore, the study employs a qualitative approach to examine the current situation of food-tech MSEs in Sweden using an exploratory approach. The data will be collected through semi-

structured open interviews. By identifying the challenges in the adoption of circular business models, the study aims to contribute to the understanding of how food-tech MSEs can achieve circularity and better contribute to the CE.

3.1.2. Research approach

The study is focused on companies that have been born under the name of "sustainable MSEs", whose value proposition is to be sustainable with less environmental impact, better for society, and generation of economic resources. However, these companies do not follow the 100% CE principle due to complex challenges.

Furthermore, the study explores how some of these companies have implemented circularity in some parts of the value chain and what makes it work. It will investigate the models they follow, and which practices serve as inspiration for new MSEs in the sector. Despite the challenges, the study aims to unveil a conceptual framework that presents the challenges that some companies face and that others have successfully overcome.

3.2. Research Design

3.2.1. Context of the study

The empirical context for this study is Food-tech MSEs in Sweden. In general, MSEs hold a critical position in any economy due to their reliance on entrepreneurial abilities and innovative practices. In Sweden, MSEs exhibit a noteworthy influence on the economy, society, and market of the country. The Small Business Act for Europe (SBA) Sweden Report revealed that "SEMs generated 61.2% of value-added and 65.2% of employment in the last years", underscoring the significance of MSEs. Additionally, since 2014, SEMs have been experiencing substantial growth, as reflected in the record-breaking double Venture Capital investment in 2021, where Swedish start-ups raised €7.8B (Björk & Matrsson, 2022). However, despite the growth, only a small fraction, around 87 MSEs, are Food-tech related.

The food-tech MSEs participating in this study are aimed to offer healthier alternatives, sustainable and decrease consumption of animal-based products while also working to minimize their overall environmental impact through the creation/implementation of more efficient "green" technologies. As a result, implementing circular initiatives is a smart choice for them. Although it seems CE and sustainability are core aspects of these companies' value

propositions, there is still much room for improvement in terms of their supply chain and business model.

3.2.2. Qualitative research

This thesis utilizes qualitative research to emphasize the high quality of knowledge and information provided by interviewees. The inductive approach is used to gather relevant data from interviews with food-tech MSEs to establish the conditions that can be presented as a framework, which has not yet been addressed in this research area. The thesis employs an iterative strategy, which involves moving back and forth between data and framework (Bell, Bryman & Harley, 2019). Qualitative research is the most appropriate methodology for this study as it enables a more profound understanding of the subjective experiences and perspectives of the challenges that these MSEs face during the transition to CE. The inductive approach in qualitative research is particularly well-suited for this study as it allows for the development of a theory based on empirical data observations (Bahari, 2010).

The data collection is from an interview with at least one active member of the food-tech MSEs in Sweden. Details of the interview guide are set out in (Appendix A). The interview guide was developed by the author of this research; however, the literature review was used as an inspirational process to develop the interview guide, for example, from authors such as Henry, Hoogenstrijd and Kirchherr (2022) in their study titled “Motivations and identities of “grassroots” circular entrepreneurs: An initial exploration”. As well as inspiration from Närvänen, Mattila and Mersirant (2021) in their study “Institutional work in food waste reduction: Start-ups’ role in moving towards a CE”.

I conducted research on more than two MSEs with certain similarities and certain differences, which provided us with a better understanding of the food-tech landscape in Sweden (Bell, Bryman & Harley, 2019).

3.3. Research strategy

3.3.1. Participant selection

This study had the aim to collect data and generate a new framework based on the interviews as inductive qualitative research. This part explains the selection criteria and their relevance to this study.

To ensure both literal and theoretical replication and to provide contextually relevant explanations, I utilized a theoretical sampling approach (Eisenhardt & Graebner, 2007). The criteria used for selecting the participants were based on their value proposition, which had to be proximate to sustainable business models in the food-tech sector and include the production of any edible products for humans. Theoretical sampling allowed me to select participants who were most likely to provide the information needed to develop and refine the framework for the successful transition of food-tech MSEs to the CE, despite the challenges (Eisenhardt & Graebner, 2007).

Multiple observations from diverse contexts are critical for extending theory-building efforts. Thus, I employed a multi-pronged sampling strategy by collecting data from the co-founders, CEO, COO, product development scientists, head of strategy, and other active parts of the MSEs involved in promoting CE and sustainability concepts, making them suitable for the study (Eisenhardt & Graebner, 2007). Details of the interviewees and their value proposition can be found in Table 3.1.

Table 3.1 Overview of the participants with real names and main description of their value proposition

List of participants	*Company name*	*Main product category*	*Respondent's role*	*The value proposition of the business*	*Founded*	*# of Employee*
Daniel Skavén Ruben	Stockeld Dreamery	Food, dairy alternatives	Head of Strategy & Special Projects	Fermented lentils and chickpeas to create plant-based spreadable cheese.	2019	43
Arwa Mustafa	Arwa AB Food	Food plant-based alternatives and cosmetics	CEO	"Developed a range of nourishing and tasty drinks and sauces that combine the properties of Swedish oats and traditional African baobab fruit."	2021	4
Matthias Lehner	Roots of Malmö AB Kombucha	functional beverage	Co-Founder	Fermented non-alcoholic drink (Craft-made)	2013	Around 5
Julian Read	Simris Alg	Food supplements	CEO	Omega-3 plant-based sourced as micro-algaes from Sweden	2011	12
Charlotte von Arnold and Salomon	Scobybaby Kombucha	functional beverage	CEO and Co-Founder	Fermented non-alcoholic drink (craft-made)	2020	2
Peter Andersson	Yelte	Food, dairy alternatives	CEO	"Develop the most sustainable and tasty plant-based foods possible" as plant-based drinks and protein alternatives.	2020	4

Dat Nguyen	Lupinta	Food meat alternatives	Food technologies	"Developing meat and soy substitutes from locally farmed lupin beans. Healthy, tasty and environmentally friendly".	2019	3 full time and 2 part time
Emil Lagerstedt	Simply no waste	functional beverage	Co-founder & COO	"All tasty creations we make are based on saved products that otherwise would have been thrown away".	2021	2
Aron Tendler	Eat:em	Food protein alternatives	CEO	Cricket food product "Our existing protein sources feed us but they don't do a lot to preserve our planet. A sustainable protein source that doesn't take a huge bite out of our planet".	2016	8
Arash Fayyazi	Saveggy	Packaging (edible)	COO	"Our bio-based edible vegan coating extends the shelf life of fresh fruits and vegetables"	2019	7 on total 3 part time 4 full time
Lennart Ahrne	Aloba	Food meat alternative	Co-founder	"We believe the world would benefit from a more healthy and sustainable way of consuming food". Sustainable and healthy Nordic raw materials from both sea and land algae, oats and barley"	2019	Around 10

3.3.2. Participants: Food-tech MSEs in Sweden

Eleven Food-tech MSEs participated in the research they had in common to be considered born-sustainable due to their main value proposition product(s) being plant-based, healthier, with lower carbon dioxide emissions and less negative environmental impact compared to the conventional food and beverage industry.

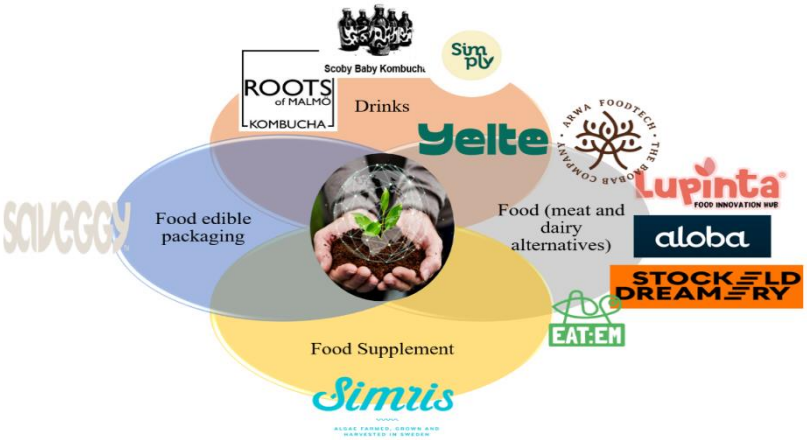


Figure 3.1 Characterization of the food-tech MSEs sector in Sweden
Source: By Author

Moreover, some of those companies have in common being founded less than ten years ago. They are considered MSEs with around 2 to a maximum of 50 employees. The companies are classified in the main product offer in Figure 3.1. The MSEs differ in some aspects, diversifying the total sample study as they have different business models (BM), some are more orchestrator BM, while other produce by themselves (see Figure 3.2 below).

The MSEs´ main descriptions are:

- 4 plant-based food alternatives to meat and dairy industry register as a Lupinta, Stockeld Dreamery, Arwa Food and Aloba.
- 4 healthy drinks or beverages companies kombucha Scoby Baby and Roots of Malmö., Simply drinks, And one dairy plant-based alternative Yelte.
- 1 food supplement plant-based company Simris Alg,
- 1 food alternatives from crickets Eat:em
- 1 food edible packaging, Saveggy

Two main classifications can be done among the participants studied since some companies produce by themselves and own their facility, then have more control in the energy use, production line and distribution. On the other hand, other businesses follow the model orchestrator business as they are in charge of product development, logistics, and other external manufacturing products for them (Figure 3.2).

Figure 3.2 Illustration of the two main classifications depending on their business model Source: By Author

3.3.3. Data collection

To collect data, I used semi-structured interview questions that focused on background and professional experiences, innovation in technologies and processes, CE adoption in mostly each step of the value chain, and high-involvement work practices. I asked questions such as how your business contributes to sustainability and what are the reasons to produce plant-based food and/or healthier beverages? and the challenges in the process of developing new alternatives and aligning the sustainable goals. Additionally, I explored the challenges, as well as the success or failures of CE adoption, the extent to which employees have the autonomy to carry out changes, and the acquisition of new knowledge and skills related to the new innovative approach.

I collected data from eleven organizations, including MSEs, those MSEs' value chain embracing the sustainable business model, and at least one part of the value chain are based on CE principles. In addition to in-depth interviews, I analysed support documentary data such as vision, mission, sustainable reports, manuals, and public websites to increase construct validity and improve theory-building efforts. To improve mine study's external validity, I employed analytical generalization to an existing theoretical stream of literature on CE.

Through analysis of the data and transcription of the conversation, it was thematic and coding for the data analysis. The study seeks to understand the challenges that have been faced by the MSEs and the stages of circularity implementation these companies are in, with the ultimate goal of creating a framework to contribute to the theoretical literature in CE applies in entrepreneurship in the food-tech sector.

Qualitative data was collected between January to March 2023, with around 60 to 90 minutes. Semi-structured interview was conducted; this was divided into seven parts with open questions and the possibility to add more information in each part, corresponding to the main topics of background and context, processing line, supply chain, marketing strategy and the pathway towards circularity. The interviews were conducted online via Zoom app, with the participation of the researcher of this thesis work and one person from the company. An oral agreement was confirmed at the moment to start the interview, as well as the consent to record, use all the information and use the real names, for academic purposes.

3.3.4. Data Analysis

To create a conceptual framework from an observational study, an inductive thematic analysis approach was conducted. The material from interviews and support extra material (documentation) were analysed to find out the main challenges the MSEs have been facing in their pathway to circularity and familiarization with the CE concept, practices, and strategies.

Analysing the interview data with approximately 66000 words in total was done manually and with Lumivero Nvivo, a software application which employs machine learning and statistical algorithms to automatically extract seed concepts from textual data. While Lumivero Nvivo provides an objective view of qualitative data, manual validation is necessary to remove non-key concepts.

I decided to follow a Gioia Methodology (Magnani & Gioia, 2023) thematic approach to hierarchically categorize the qualitative data. The Gioia methodology is a qualitative approach to creating grounded theories in various fields. It emphasizes the systematic identification, analysis, and interpretation of patterns and themes in qualitative data to meet top journal standards. The methodology is based on three pillars: creating a data structure, developing a grounded model from that structure, and presenting findings in a persuasive narrative. It involves initial data analysis, generating two-sentence blocks of themes and concepts, and

producing a thematic and conceptual map to identify core themes based on their importance in the data set (Magnani & Gioia, 2023). The data analysis steps are presented below.

First-order codes: creating informant centric representations of the CE challenges

To begin the coding process, I first grouped and classified all the responses according to the order in which they appeared in the interview guide. The interview guide itself was divided into seven parts (see Appendix A). Next, I focused on identifying the concepts and experiences that were most frequently mentioned by the participants using the software. I carefully examined these concepts and experiences, as they appeared to be the most relevant for developing theories as described by Magnani and Gioia (2023).

As a result, a classification of first-order concepts was obtained based on the sentences and keywords that are relevant to describe the phenomenon of challenges that MSEs in the food-tech sector face adopting CE model strategies. With this method, it can connect the similarities between the participants and also distinguish between the discrepancies (Bell, Bryman, & Harley, 2022). Since the participants have different years of experience in business development, they could have different challenges depending on the stage they are in.

For instance, twelve first-order codes were generated from the information transcripts provided by the interviewees. These were classified into three main second-order categories: limitations in local sourcing, struggles with CE packaging, and outsourcing of materials, which together formed an aggregate dimension known as "limited raw materials."

The extra material (documentation) extracted from their official website was analysed as support material, specifically in the parts of "about us", "our history", "circularity practices", and "sustainability", these concepts serve as support to understand what was expressed by the interviewee and support the coding of the topics (Bell, Bryman & Harley, 2022).

Second-order categories: linking empirical observations to abstract concepts

A total of fifty-six first-order categories were organized into a twenty second-order categorization in a structured way, and they conform five main aggregate dimensions; some of the final aggregate dimensions were inspire and adopted from Malik et al. (2022) and Pannila et al. (2022). For instance, consumers' choice hinders CE new developments is the first-order category and society and cultural limitations are second order theme, as the aggregate

dimensions will be consumer resistance to CE products. These challenges are multi-faceted, arising from a combination of factors that are unique to their industry and culture, as well as inherent structural issues.

To refine the analysis, a theoretical coding process was employed, using an abductive approach to combine the data from the participants, phenomena, and comparison with literature. The result was the development of a conceptual framework presented as a flow diagram to illustrate the whole pathway of the SEMs challenging adopting CE and the possibility to transitioning a CE with key strategies to be implemented.

Developing the conceptual model

Developing a conceptual model is not only important but also a critical step in comprehending and analysing intricate phenomena such as the transition of food technology MSEs to CE model. The process of developing a conceptual model begins by addressing specific research questions, followed by generating initial codes, refining them through iterative process, and categorizing them into aggregate dimensions based on similarities and differences. In addition, an exhaustive review of the literature is conducted to identify related theories and concepts that either support or contradict the findings (Leshem & Trafford, 2007). Ultimately, the conceptual model produced reveals the challenges faced by food-tech MSEs during their transition to the CE model. The model also presents an idealized representation of how the successful implementation of CE strategies in food-tech SEMs in Sweden could be supported, providing valuable insights for policymakers and stakeholders in the food-tech sector.

3.4. Reflection on methodological limitations

One limitation to the reliability of this research is the constructivist approach utilized, which involves subjective interpretation and conceptualization of the challenges faced by MSEs in the food-tech sector in Sweden as they adopt CE strategies. This approach is influenced by the researcher's preconceived ideas, as well as social, political, cultural, and demographic factors. The researcher assumes the role of a facilitator and participant in integrating different perspectives on the issue, which can introduce potential biases (Cypress, 2017). Furthermore, the only participation of the researcher in the data collection process introduces limitations, as it relies on limited data sources. The interviews conducted only included MSEs, without the possibility of interviewing other stakeholders such as agricultural producers, manufacturers,

distribution channels, consumers, and government entities. This lack of triangulation, or multiple perspectives, may impact the comprehensiveness and robustness of the findings, limiting their generalizability to a broader context.

It is crucial to acknowledge and address these limitations in order to ensure the reliability, credibility, and validity of the research findings. Future research in the field of food-tech should include supply chain management to consider incorporating diverse perspectives associated with CE adoption by MSEs in the food-tech sector in Sweden.

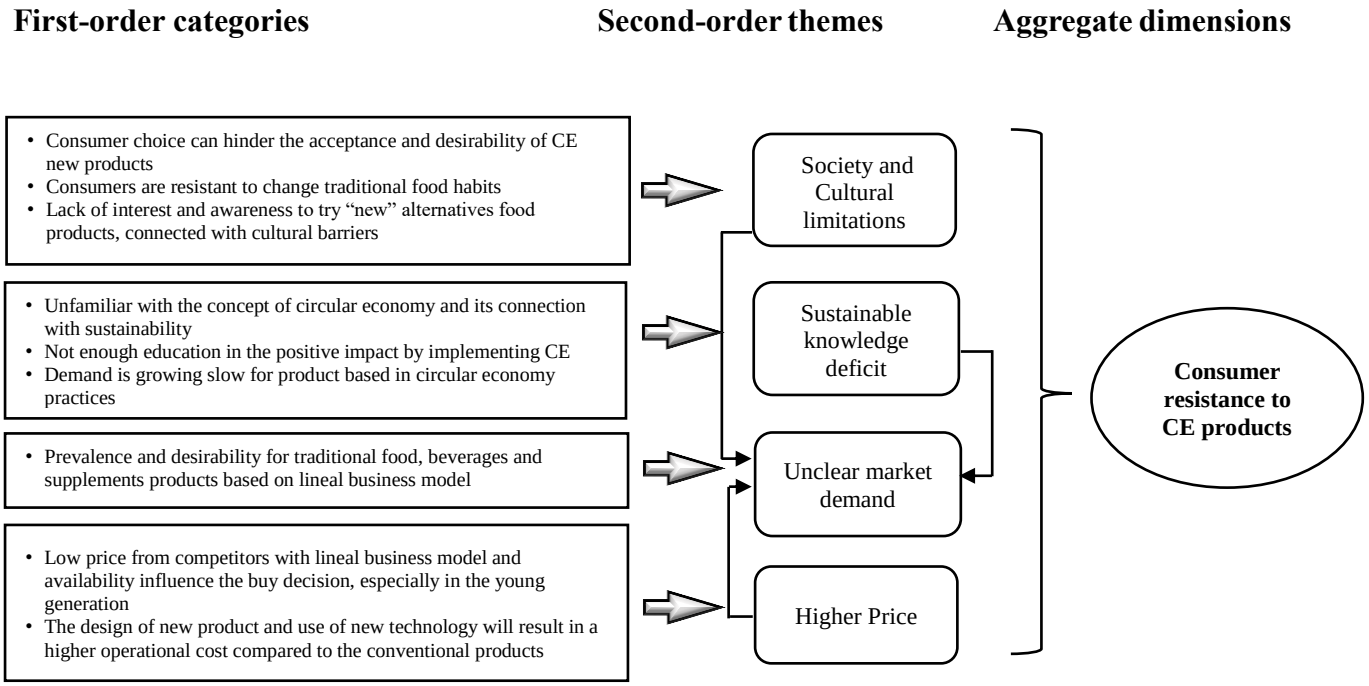
3.5. Ethical considerations

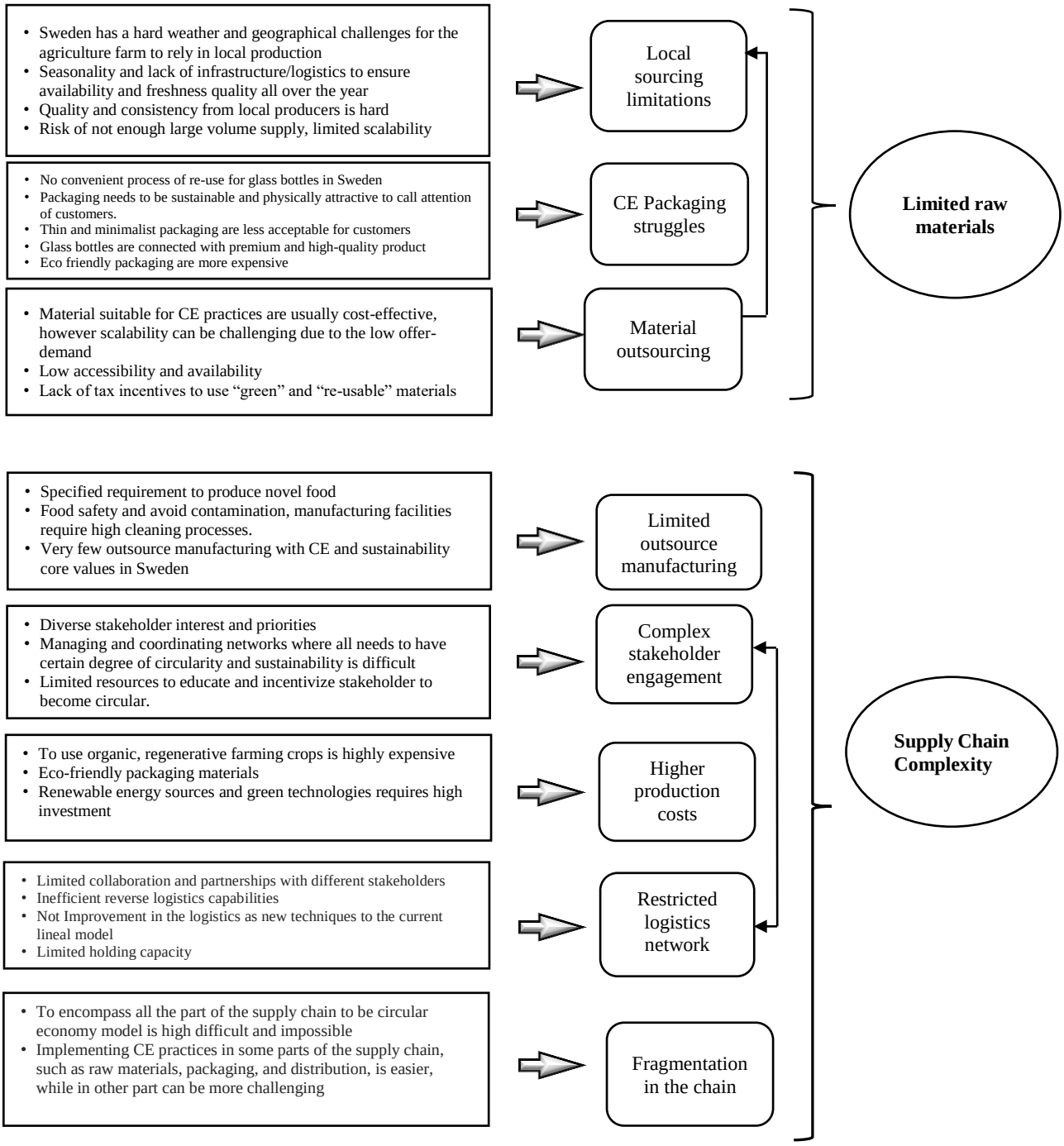
Ethical considerations are crucial in qualitative research, including obtaining informed consent. In this investigation, interviews were conducted online via Zoom, and participants were asked orally if they agreed to be recorded and have their information used for academic purposes and they said “yes”. All eleven participating MSEs agreed that their real names can be used and quoted as well as their company name. Audiotapes of the interviews and transcripts are available by the author (saved in OneDrive App), indicating adherence to established ethical guidelines. Participants were also informed that sensitive information, such as manufacturing processes, ingredients, and supplies, would be kept confidential due to intellectual property protection, which is acceptable. Adhering to ethical principles and guidelines is crucial in qualitative research to ensure responsible and ethical conduct throughout the study (Lehnert et al. 2016).

4. FINDINGS

This section discusses the empirical findings on the challenges faced by MSEs. These challenges are multidimensional and occur at various levels of the business's value chain

This section presents the findings concerning the challenges facing MSEs in transitioning to CE based on empirical observations of the food-tech sector in Sweden. The findings show that these challenges are multi-dimensional and encountered across the different value chain levels of the business. The main challenges are represented by five aggregate dimensions: *consumer resistance to CE products*, *limited raw materials*, *supply chain complexity*, *impeded innovation-technology*, and *ambiguity in legislation*. Figure 4.1 offers the results of the data analysis in full detail and extended version. The next sections draw on the empirical insights to explain barriers to CE based on the data collection (for more details of supplementary quotations from the interviewees, see Appendix B).




• Sweden has a hard weather and geographical challenges for the agriculture farm to rely in local production
• Seasonality and lack of infrastructure/logistics to ensure availability and freshness quality all over the year
• Quality and consistency from local producers is hard
• Risk of not enough large volume supply, limited scalability
Local sourcing limitations
• No convenient process of re-use for glass bottles in Sweden
• Packaging needs to be sustainable and physically attractive to call attention of customers.
• Thin and minimalist packaging are less acceptable for customers
• Glass bottles are connected with premium and high-quality product
• Eco friendly packaging are more expensive
CE Packaging struggles
• Material suitable for CE practices are usually cost-effective, however scalability can be challenging due to the low offer-demand
• Low accessibility and availability
• Lack of tax incentives to use “green” and “re-usable” materials
Material outsourcing
Limited raw materials
• Specified requirement to produce novel food
• Food safety and avoid contamination, manufacturing facilities require high cleaning processes.
• Very few outsource manufacturing with CE and sustainability core values in Sweden
Limited outsource manufacturing
• Diverse stakeholder interest and priorities
• Managing and coordinating networks where all needs to have certain degree of circularity and sustainability is difficult
• Limited resources to educate and incentivize stakeholder to become circular.
Complex stakeholder engagement
• To use organic, regenerative farming crops is highly expensive
• Eco-friendly packaging materials
• Renewable energy sources and green technologies requires high investment
Higher production costs
• Limited collaboration and partnerships with different stakeholders
• Inefficient reverse logistics capabilities
• Not Improvement in the logistics as new techniques to the current lineal model
• Limited holding capacity
Restricted logistics network
• To encompass all the part of the supply chain to be circular economy model is high difficult and impossible
• Implementing CE practices in some parts of the supply chain, such as raw materials, packaging, and distribution, is easier, while in other part can be more challenging
Fragmentation in the chain
Supply Chain Complexity

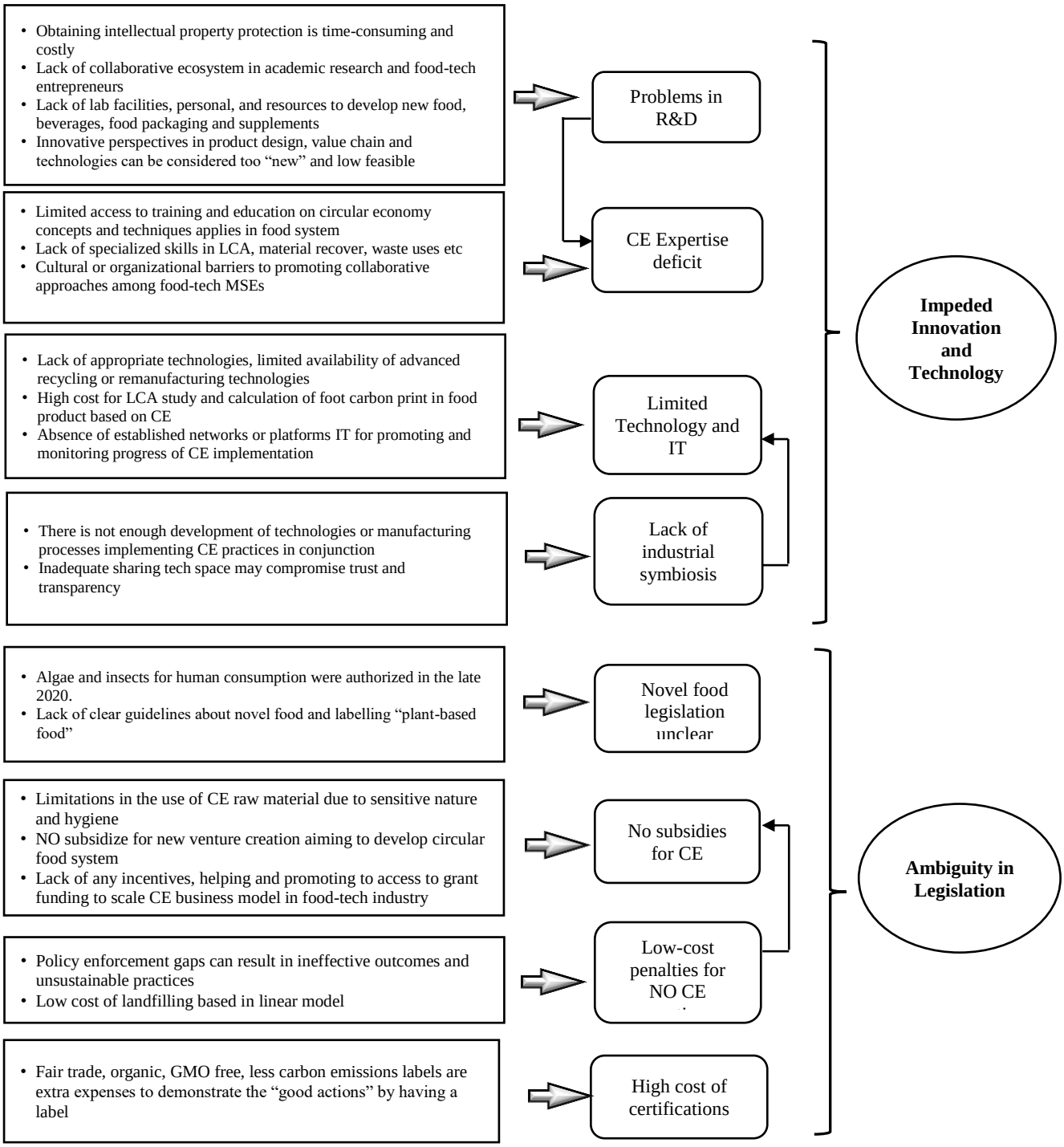


Figure 4.1 Data structure
Source: By Author

4.1. Consumer resistance to CE products

Consumers play a crucial role in driving the development of products and services; their ability to influence demand and create opportunities for new ventures cannot be underestimated

(Borrello et al. 2020). The data analysis in this study reveals that consumers pose considerable challenges in the implementation of CE by influencing MSE's decision-making process. Negative responses from consumers emerges as a significant barrier for entrepreneurs, highlighting the need for their approval for CE success. The data structure delineates four challenges in relation to consumer resistance which are illustrated by four second-order concepts: *society and cultural limitations, sustainable knowledge deficit, unclear market demand* and *higher price*. These challenges are deliberated below.

4.1.1. Society and cultural limitations

Based on the research data it has been found that consumer resistance to adopting CE products can take different forms. The study identified three primary forms of resistance to CE products. Firstly, consumers' choices can hinder the acceptance and adoption of CE practices in new products, which is considered to be a significant challenge. Consumers may be hesitant to try new products that they perceive as unfamiliar or untested and may prefer products that are familiar and convenient, which is expressed by one of the kombucha producers Von Arnold, *"When our products are on the shelf market, people still prefer to choose Coca-Cola and soda drinks instead of healthier drinks with a better environmental impact like Kombucha has, perhaps as a cultural decision and neophobic to try something new"*.

Consumers are resistant to changing their traditional food habits, particularly in relation to the consumption of new and unfamiliar food products. In that sense, Lennart Ahrne said that *"we cannot limit our market to only Vegan, vegetarian or plant-based diet, our product is for everyone, for people who are worried about the environmental impact from their food and beverages consumption; otherwise, people will misunderstand the product target"*. The resistance may stem from concerns about the taste and quality of new products, as well as potential health and environmental impacts.

Lack of interest and awareness about the benefits of trying "new" alternative food products may hinder their adoption. This lack of interest may be linked to cultural barriers, such as a preference for traditional food products. Similar to Tendler (CEO of Eat:em), that highlights the challenges his cricket protein food faces in getting consumers' trust, stating that *"Despite our efforts to promote our sustainable food products as a healthier and more sustainable option, we are still facing challenges in getting consumers in Sweden to try them. However, crickets have been part of the traditional diet in several countries in Asia and Mexico. But*

Swedes are hesitant to try new and unfamiliar products, especially those that are not part of their cultural food traditions." He further explained that *"This resistance may be driven by cultural barriers, where certain food products are perceived as part of a particular cultural or social identity."* Tendler highlighted that the lack of awareness and interest is a major obstacle to adopting CE food products and can only be addressed through focused marketing and educational initiatives.

4.1.2. Sustainable knowledge deficit

Customers' lack of knowledge regarding sustainability and CE practices is hindering the adoption of CE practices. Due to their unfamiliarity with the concept of CE and its connection with sustainability. Some of the participants emphasized the need for companies to educate customers on the importance and benefits of CE practices, declaring Lagerstedt (Simply no waste), "*We need to help consumers to understand the value of circularity model, to create better food alternatives, the potential to upcycle food waste ingredients and offer to innovate nutritious drinks and food."* As a consequence, the demand is growing slowly for products based on CE practices. Therefore, companies need to take the initiative to educate customers to increase demand for sustainable products (Peschel & Aschemann-Witzel, 2020).

4.1.3. Unclear market demand

It has been acknowledged that, unlike traditional business models where market demand leads to the creation of new products, in business models that adopt certain CE practices, the goal is not necessarily to meet demand or launch an improved version of an existing product in a known market. Instead, the goal is to improve a process that has a lower negative impact on the environment and is based on sustainability dimensions (Bocken & Short, 2020). Therefore, it is likely that the market may not recognize the need for the new product due to its innovative nature. This is observed in the statement by Daniel Skavén Ruben (Stockeld Dreamery) *"We try to understand the trend towards plant-based diets based on sustainability, health and animal welfare, but meeting consumer demand remains a challenge. Consumers still expect dairy plant-based alternative products to look, taste, and have the texture of animal-based products."*

4.1.4. Higher price

MSEs in food-tech often face the challenge of having higher prices compared to traditional linear business models. As Read (Simris) acknowledges, *"…our product is more expensive compared to the competitors from animal-based. Our packaging is a reusable glass bottle; once the customer buys the first time, then they will need to buy the refill, and it will be cheaper."* While the CE product may have long-term benefits for animal welfare and sustainability, the higher initial cost may be a barrier for some consumers, especially the younger generation, who are more influenced by low prices and availability (Rizos et al. 2016). Moreover, the adoption of new technology and production processes in CE practices may result in higher operational costs, further contributing to the higher prices of the products, as stated by some of the participants Skaven Ruben *"Our production line is specifically designed to produce our product, as no other company has the same product needs as us. This required a significant investment, which is reflected in the final price of our product."*

4.2. Limited raw materials

The current food system has a significant impact on climate change, primarily due to animal-based food production and food waste and losses. The extraction, processing, and transportation of food products are among the most significant contributors to this impact (FAO, 2018). Raw materials are the starting point of the food supply chain, making it crucial to understand where they come from to determine the level of sustainability of MSEs. The data structure demarcates three second-order concepts: *local sourcing limitations, CE packaging struggles* and *outsourcing materials*, those are deliberated below.

4.2.1. Local sourcing limitations

One of the key challenges is the difficulty of relying solely on local production due to Sweden's harsh weather and geographic limitations for agriculture. Skaven Ruben recognized that *"Sweden has zero capacity to properly store any seasonal crop produced, which limits self-sufficiency when the weather turns cold"*. This is known as seasonality and a lack of infrastructure/logistics to ensure availability and freshness quality throughout the year. However, the customer seems highly motivated to consume food produced in Sweden from Swedish fields. It is perceived as high quality, environmentally friendly and safe, as Lennart

Ahrne (Aloba) stated *“It is a big trend that the products should have the Swedish flag, the consumer and retail ask for resource locally and produce in Sweden.”*

When raw materials are sourced from small-scale producer farms that are relatively new to the industry, it can be challenging to maintain consistent quality and reliability, Skaven Ruben said *"Our local suppliers are often small farmers who are new to production, and sometimes they struggle to meet our demand for raw materials."* Finally, there is a risk of not having enough large volume supply to meet customer demands, limiting scalability. Skaven Ruben explained, *"As a business mentality, we cannot be limited by the scalability of local sourcing. While we are committed to supporting local producers, we also need to ensure that we can meet the volume demands of our customers. For this reason, we have multiple suppliers from different countries to cover extreme demand."*

4.2.2. CE packaging struggles

New MSEs may struggle to choose packaging materials because they are faced with the challenge of balancing environmental sustainability and customer preferences. There is a growing demand for eco-friendly packaging materials due to increasing concerns about environmental degradation and climate change. On the other hand, customers are often drawn to visually attractive packaging that can highlight the product and make it stand out on the shelves. Thin and minimalist packaging are less acceptable for customers (Nguyen et al. 2020); this issue worries Lennart Ahrne and his team. *"We're proud to have environmentally-friendly packaging, but it is not showcasing our product effectively in the supermarket, it's not grabbing the attention of customers, maybe due to colours, thin material and less design,* which agree with other food-producer that stated that *“we're considering redesigning our packaging to make it more visually appealing and attractive to our customers even though we need to compromise the sustainability of the packaging.”* Conclude that packaging needs to be sustainable and physically attractive to call the attention of customers.

The packaging material that presents the highest challenges in this research was the glass. Although it is a more environmentally friendly option than plastic, it is also more costly, heavier and can be harder to manage. Reusing glass requires processing facilities, which many MSEs may not have the capacity for; explained by Matthias Lehner, *"Our bottles of glass in Sweden are recycling, but they are not reusable since the logistics in Sweden is quite challenges, however in Germany, we plan to install a manufacturing and the glass bottles will*

be reusable." There is no convenient process for reusing glass bottles in Sweden. Consumers generally have a positive perception of beverages in glass connected with premium and high-quality products, which can be an advantage for MSEs looking to stand out in the supermarket and restaurants stated by Lagerstedt, *"the customer in the restaurant has a high preference for drinks in a glass bottle and connect the glass with a premium and more expensive product."*

4.2.3. Material Outsourcing

The food producer encounters significant obstacles in sourcing raw materials that align with their commitment to CE practices. They face difficulties in finding eco-friendly and sustainable raw materials and supplies that can be locally produced, reused, recycled, and upcycled. The co-founder Von Arnold and Salomon recognizes the scalability limitations caused by the low demand and accessibility of sustainable materials; explain *"Due to our commitment to sustainability, we only want to use materials that are ecological and can be reused or recycled. However, we often struggle to find these materials locally; then we have to outsource them. This not only increases our costs but also makes scalability difficult."*

Arwafood is an exceptional case where they aim to maximize the use of baobab fruit produced in Sudan, Northeast Africa. Although the fruit needs to be imported to Sweden, the company follows fair trade practices that generate economic income for the local community. With innovative green technologies, they utilize all parts of the fruit, stated by the CEO, Arwa Mustafa "*We have finalized the research on how to further use the press-cake after the oil production as well as the shell of the fruit".* This process follows a 100% CE model and has the potential to produce promising results, impacting the three pillars of sustainability for both Sweden and Sudan.

Unfortunately, the lack of tax incentives for using green and reusable materials is another hurdle for MSEs. As Von Arnold and Salomon *"It's unfortunate that there are no tax incentives to encourage companies to use sustainable materials. If the government could provide some sort of tax break or incentive for using green materials, it would make a big difference for companies like us."* As Andersson confirmed, *"In Sweden, large amounts of subsidies are designated to support the livestock industry, especially the dairy industry. The bigger and more monopolized it is, the more financial support they receive. And we know that cattle are the most polluting animals in the food system."*

4.3. Supply chain complexity

Some of the food-tech MSEs participating in this study have successfully applied CE principles to some parts of supply chain, leading to improved efficiency through a closed-loop system that addresses traceability and material flow challenges. The second-order categories were identify as *limited outsource manufacturing, complex stakeholder engagement, higher production cost, restricted logistics* and *fragmentation in the chain*, explained below.

4.3.1. Limited outsource manufacturing

Unfortunately, very few outsource manufacturing facilities prioritize CE and sustainability core values in Sweden, making it difficult for the MSEs to find suitable partners. In Sweden, there are a few outsources manufacturing with CE and sustainability core values said by Tendler, *"Finding outsource manufacturing that can produce our products under sustainable conditions is challenging. We are looking for companies that use renewable energy sources, inputs from Sweden or Nordic countries, and follow sustainability. But it is difficult to find these at reasonable prices that allow us to generate income".* On the other hand, Mustafa said *"due to our specific requirements for food production, there is a challenge to find food companies willing to produce for us",* which is reflected in the specified requirement to produce novel food and the food safety and avoid contamination, manufacturing facilities require high cleaning processes or two different processing line the problem that Tendler is a concern *"many outsource manufacturing cannot produce our product due to the high risk of cross-contamination and allergen risk and no one else is producing here."*

4.3.2. Complex stakeholder engagement

One major discovery from examining supply chain challenges is that effective collaboration among stakeholders is vital to establishing a well-balanced supplier ecosystem. Achieving this requires managing and coordinating networks that incorporate circularity and sustainability; expressed Ahrne *"You need to have a good supply chain, the retail network in Sweden needs to verify the good environmental practices you are having in order to establish contact with you."* And reflected by this affirmation Lehner said *"To have key partnership with suppliers, retailers, and distributors is crucial, as well as align our values and common interest."*

However, there is a limited resource to educate and incentivize stakeholders to become circular. The farmer and agriculture sector where the first-hand producer lack of knowledge of

sustainable and CE practices adaptable to the production Lehner said *"our farmers do not invest time and sources on composting, biofertilizers, agroforestry and crop rotation, due to the high profitability that linear model give to them in the short-term"* which also is interpreted as diverse stakeholder interest and priorities.

4.3.3. Higher production costs

Using organic and regenerative farming crops can be a costly investment for food-tech MSEs. This is because these methods require more manual labour, which can increase production costs. For instance, a food-tech MSEs wants *"produce organic ingredients will need high invest in specialized equipment and hire skilled labour to grow and harvest these crops"*. This may result in a higher price point for the final product, which can be a challenge for companies that want to remain competitive in the market; verified by Lennart Ahrne *"We avoid using soy-based products, however, other companies used and their products are cheaper, however, we know that soybean is mostly imported from sensitive areas as Amazonas Brazil"*, as well as the use of renewable energy sources and green technologies requires high investment.

The majority of the participants are currently investing resources in eco-friendly packaging. While these materials may be more sustainable, they are more expensive to produce; for example, Andersson said that *"We want to use biodegradable packaging made from plant-based materials, and we needed to invest in research to find reliable suppliers who can produce the materials at a reasonable cost."*

4.3.4. Restricted logistics network

Some of the founders of the food-tech MSEs seems to be worried about the limited collaboration and partnerships with stakeholders. Someone expressed that Skavén Ruben *"finding reliable logistics partners to distribute their products efficiently to different locations in Sweden is a challenge, leading to slower operations and increased costs."* While the supplier list prioritizes local and Nordic produce, they also need to import some raw materials, Skavén Ruben said *"...from those countries like China we could keep operational cost lower and demand higher volumes, however it is not the most sustainable alternative."* But in Sweden is limited capability to have reverse logistics which favours choosing far country producers.

The operations team from several of the interviewee are optimizing their logistics, but they face a hurdle in accessing the latest technologies and techniques to keep up with larger food-

tech players in the market, as one of the interviewee, anonymously said, *"we are aiming to implement automated warehouse system to increase the accuracy of order fulfilment and inventory, however the use of AI is limited by the high cost"*. Furthermore, the start-up's CFO raises concern about limited holding capacity, said that *"we have limited storage space and other logistics infrastructure hindering the effective scaling of operations, which is slower the whole process to become CE in the whole supply chain"*. This is having an impact on the ability to meet demand and grow the business.

4.3.5. Fragmentation in the chain

The fragmentation makes it difficult to coordinate and integrate the different stages of the chain to adopt CE practices, as result encompass all the part of the supply chain to follow a CE model is high difficult and almost impossible. Expressed Andersson *"The complexities of coordinating all the various stakeholders and ensuring everyone is aligned with our sustainability goals make it a difficult and ongoing process."* For instance, while some players may be willing to adopt sustainable practices in their operations, others may be less enthusiastic. Overall, the interviewees agreed that the fragmentation leads to lack of consistency and coordination, resulting in gaps in the adoption of CE practices across the supply chain. Moreover, it creates barriers to transparency and traceability to track the movement of goods and materials.

Implementing CE practices in some parts of the supply chain, such as packaging, processing technology and distribution, is easier than outsourcing local raw ingredients, transport, and energy to keep long-shelf life as Von Arnold said *"We need to use ingredients produced in other countries, but we manufacture in Sweden using renewable energy sources. However, our emissions are not neutral, and we still have an impact."* Establishing collaborative and integrated relationships among stakeholders in the supply chain is crucial in addressing these challenges as Haller et al. (2022) explains, it requires adopting shared standards and practices, and setting common sustainability goals and targets.

4.4. Impeded innovation and technology

MSEs struggle to adopt CE practices due to lack of sustainable and circularity knowledge, there is insufficient education about the positive impact of CE practices in food-tech sector. Four

second-order categories reflect these challenges: *problems in R&D*, *CE expertise deficit*, *limited technology and IT* and *lack of industrial symbiosis*.

4.4.1. Problems in R&D

These challenges can make it difficult to scale up and outsource manufacturing facilities, which can further slowdown the product development process as Dat Nguyen from Lupinta said *"the challenge is the lack of scientific research on the ingredients we are using, we have to study from the begging, it is exhausting."*

Innovative perspectives in product design, value chain and technologies can be considered too "new" and low feasible, similar as Fayyazi (Saveggy) said *"Our technology needs to be protected, process of patent require a lot of legal advisors, financial source and several months to be complete before we could try to find to scale up."* Seems as challenge to obtain intellectual property as well to be time-consuming and costly. Where Read is agreed with Fayyazy, who said that *"we are aiming to create revolutionary dietary supplement with anti-cancer properties, and it is in phase of development, clinical trials and license, but we must protect the intellectual property then it is many factors that are barriers."* Perceived as lack of lab facilities, personal, and resources to develop new food, beverages, food packaging and supplements.

4.4.2. CE expertise deficit

Many MSEs have limited access of training and education to implement CE practices throughout their entire supply chain, which makes it difficult to achieve true sustainability. Affirmed by Von Arnold and Salomon (Scobybaby kombucha) that positively said "*Sustainable knowledge deficit is a significant challenge faced by food-tech when it comes to adopting CE practices. Many companies are unfamiliar with the concept of CE and its connection with sustainability; however, we are educating ourselves and work to educate our customers",* moreover, Read said *"This lack of knowledge and understanding has resulted in slow growth in offer of products based on CE practices."* Reflected as lack of specialized skills in improve life cycle assessment and material recover as well as limited cultural or organizational barriers to promote collaborative approaches among food-tech MSEs.

4.4.3. Limited technology and IT

Lack of appropriate technologies, limited availability of advanced recycling or remanufacturing technologies are challenging in the food-tech sector as mentioned by Lagerstedt *"we needed to create our own technology to make the extraction of the components from the raw materials, we have to invest in our own equipment line and design new processing."* This can be a costly and time-consuming process for companies, particularly for MSEs, same situation for the high cost for LCA study and calculation of foot carbon print in food product based on CE, particularly for MSEs with limited financial resources.

There may be an absence of established networks or platforms for promoting and monitoring progress in CE implementation. This can make it difficult for companies to connect with other stakeholders in the CE, said by Read that *"Do not share best practices and monitor the progress in adopting CE practices, hinder the scalability of CE practices."*

4.4.4. Lack of industrial symbiosis

It is crucial to develop new technologies and manufacturing processes that integrate CE practices. However, there is not enough development of technologies or manufacturing processes implementing CE practices in conjunction, said by Mustafa *"If we want to be successful, we need to build our own facilities, but it is expensive, it requires special conditions and it is not feasible to do as a single company."* On the other hand, Skavén Ruben said that "*we do not have good networking in academic sector to have more collaboration to collaborate in research, it is difficult to get part if you do not have the connections."*

4.5. Ambiguity in Legislation

Sustainable food system based of CE model is a complex concept that involves achieving multiple objectives, which can sometimes lead to policy incoherencies. There is often ambiguity and disagreement about which aspects of the issue are the most important and how they should be prioritized CE practices. Legislation is an effective tool to promote sustainability, however it is a "double-edged sword" (Schebesta & Candel, 2020). For instance, incentivizing the reduction of food waste and promoting its use may conflict with other objectives such as ensuring food safety, hygiene, and affordability. Four main second-order categories were defined as *novel food legislation unclear, no-subsides for CE, low-cost for no-CE practices* and *high cost of certifications*, explanation below.

4.5.1. Novel food legislation unclear

Tendler explains that *"The European Union authorizes insects as food in 2020, as a safe ingredient, even if insects have been part of the different cultures diet from centuries like in Asia, it is just now to become legal to use it here"*, similar situation for some kind of algae and insects were authorized by the food legislation recently and still is ambiguous and lack specificity, Read said *"due to the novelty and lack of guidelines for insect and algae farm system, it is rare to find enough local suppliers in Sweden, for that reason we need to import the novel ingredient."*

The interviewees agreed that there is not uniformity in the definitions of food-related terms, facing legal challenges related to labelling and advertising novel products, the majority of the participants in this study agreed in the lack of clear guidelines about "plant-based food" which limits their developing and marketing processing.

4.5.2. No subsidies for CE

Many of the participant agreed with the affirmation of Lagerstedt *"Food waste as raw material needs to be collected and treated with extremally high hygiene standards, which is costly and logistically complex,"* therefore, there are limitations in the use of CE raw materials due to sensitive nature and hygiene. Moreover, it was mentioned anonymously *"without financial support, it is difficult for the start-ups to create a business model that prioritizes CE practices,"* comprehend as lack of subsidize for new venture creation aiming to develop circular food system. There is a lack of incentives and promotion to access grant funding to scale CE business models in the food-tech industry in Sweden, which further hinders the development of circular food systems. Concluding by two CEO food-tech MSEs that *"it is challenging for food-tech MSEs to innovate and create a sustainable and CE in the food industry and be competitive."*

4.5.3. Low-cost penalties for NO CE practices

Some of the CEO of the MSEs food-tech in Sweden, expressed their frustration about the lack of regulatory enforcement in the food industry. Someone anonymously said, *"even everyone knows the impact that meat and dairy industry have to the environment, pollution, and animal welfare, still there are continue with their unsustainable practices, still in Sweden is importing soybean from Amazonas, as an example."* The participants consider that the legislation about sustainability and circularity are ambiguous and vague; policy enforcement gaps can result in

ineffective outcomes and unsustainable practices. On the other hand, one of the fermentable companies produces bio-waste in their process, it can be used as compost, the CEO said, *"but the cost of transportation is higher than simply throwing it away."* The low cost of landfill based on a linear model discourages CE practices.

4.5.4. High cost of certifications

There is a considerable increasing demand for sustainable, healthy, and ethical products. However, the pursuit of certifications such as fair trade, organic, GMO-free, and low carbon emissions labels are extra expenses to demonstrate the "good actions" by having a label as some of the participants already have invested high amount of money in carbon footprint said *"We need to demonstrate the significant positive impact our product has on the environment. Our food product produces only one-fourth of the emissions compared to animal-based products. However, covering the Life Cycle Assessment (LCA) cost for certification is extremely expensive".* These labels may attract conscious consumers, the high cost of certification can create significant challenges for MSEs, explain by the co-founder that *"we are currently going through the process of obtaining B Corp certification. It is challenging, demanding, and expensive. However, we want to demonstrate our positive impact, while other companies are engaging in destructive practices and profiting from them."* The result will be discuss in the next section.

5. DISCUSSION

This chapter aims to develop a grounded theory framework based on the empirical evidence from the study to comprehensively understand the challenges faced by food-tech MSEs in Sweden.

5.1. Revisiting the research questions

The main findings uncovered the challenges encountered by Swedish food-tech MSEs when implementing CE practices for sustainability as the research questions were formulated. The challenges are categorized as both internal and external. External challenges include consumer perceptions and resistance to CE products due to socio-cultural barriers, as well as ambiguity in legislation. Internal challenges revolve around the sourcing of raw materials, which affects the supply chain, resulting in increased complexity. Moreover, innovation and technology are interdependent and pose significant obstacles to the successful establishment of new ventures based on CE models (see figure 5.1).

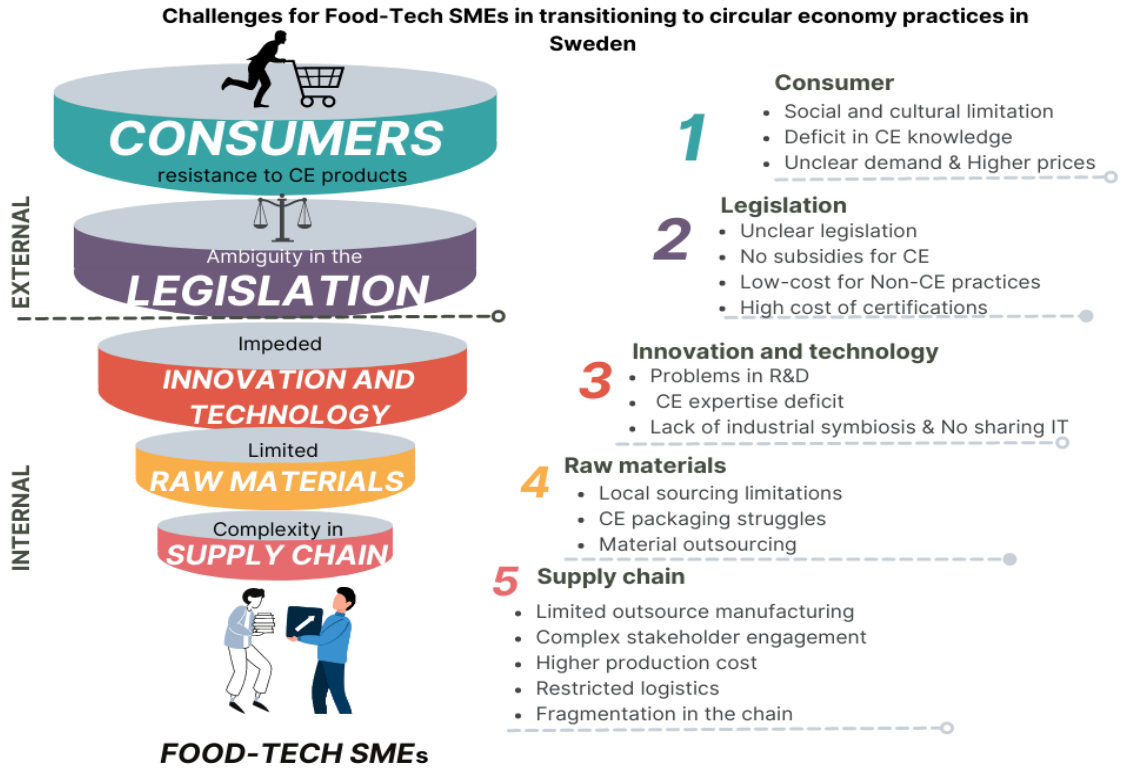


Figure 5.1 Main challenges in adopting CE practices by five aggregate dimensions and their second-order themes
Source: By Author

Promoting CE practices among food-tech MSEs in Sweden is crucial for achieving sustainability and reducing environmental impact. In figure 5.1, the most significant external challenges for entrepreneurs include consumer perceptions and resistance to CE products due to socio-cultural barriers. Additionally, ambiguity in legislation and a lack of collaboration are considered another external challenge that is interconnected with consumers' interactions, which both influence prices through demand, subsidies, and importation (Galli et al. 2018).

Consumer behaviour is a major obstacle that entrepreneurs face when adopting CE practices. Society and culture are at the core of this challenge. Consumers often lack awareness of the impact of their choices and continue to demand linear model-based products that follow the "take-make-dispose" approach (Hamam et al. 2021). Moreover, consumers are unwilling to pay higher prices for CE products, and they tend to prefer visually attractive products with excessive packaging that can be difficult to recycle, reuse, or be biodegradable (Szilagyi et al. 2022).

Studies by Takacs, Brunner and Frankenberger (2022), Muscion and Sisto (2020), and Hamam et al. (2021) indicate that lack of awareness and acceptance among consumers are the main barriers to implementing CE measures. Takacs, Brunner and Frankenberger (2022) affirmed, *"MSEs claim the prevalence of a cheapness paradigm, the decay of values, and a throwaway mentality, making the implementation of CE measures challenging".* The main challenge lies in persuading consumers to accept practices, strategies, models, and final products/services based on CE principles. It is recognized by the interviewees that there is need to address consumer resistance to CE products. As a result, the venture must focus on designing effective strategies for educating consumers about the advantages of CE products, building trust in the reliability and effectiveness of these products, and promoting the wider adoption of CE practices (Muscio & Sisto, 2020).

However, the role of consumers in the transition to CE in food system has not been fully explored in the literature, and it is important to understand their engagement and willingness to change, as Paparella et al. (2023) stated in their exploratory analysis: *"The transition towards a CE system and the success of related initiatives, indeed, depends on consumers' willingness to change their routinized behaviour at different stages of their everyday life, such as decision-making at purchase and/or end of life management moments."*

Furthermore, consumers face a dilemma in choosing between the familiar "old way" of linear consumption and the less familiar but more sustainable "new way" of circular consumption (Paparella et al. 2023; Takacs, Brunner & Frankenberger, 2022). The transition to a CE requires a significant shift in consumer behaviour, which can be challenging for some individuals. A clear example of the battle to change customer preferences are Scobybaby and Roots of Malmö, both are trying strongly to be competitive in a saturated market of the beverage industry, which is full of sugar, artificial additives and highly pollute (Nguyen et al. 2009).

Limited raw materials pose challenges for MSEs committed to circular practices, such as local sourcing, eco-friendly packaging, finding sustainable materials, and outsourcing manufacturing that aligns with their sustainable values. Without tax incentives for green materials, MSEs struggle. Indeed, the development of more sustainable protein and nutritious plant-based food options is crucial for a successful circular food system (Herrero et al. 2020).

Appropriate agricultural production is a crucial renewable resource for a CE that could operate through industrial symbiosis. To implement a CE successfully, it is essential to consider all material flows in the value chain and understand how the materials used in products affect end-of-life waste management. Studies by Chen et al. (2019) and Gedi et al. (2020) have demonstrated the positive impact of circular practices on reducing food waste and improving resource efficiency.

Regarding packaging as supply, food-tech MSEs must prioritize finding a balance between sustainability and visual appeal when selecting packaging materials. They can achieve this by researching and exploring new materials and designs that are both eco-friendly and visually attractive. In fact, Nguyen et al. (2020) investigated the perception of eco-friendly packaging among consumers and found that consumers' knowledge is often limited to the concepts of materials used and the visual appeal of the packaging. Consumers prefer environmentally friendly materials, but they also desire packaging that is visually attractive. However, many consumers may not be aware that factors such as full colour, graphic design, thickness, and weight can also increase the carbon footprint of the packaging. Educating customers about the importance of sustainable packaging choices fosters a loyal customer base that values environmental sustainability (Nguyen et al. 2020).

Stakeholder engagement is crucial in creating a balanced supplier ecosystem, but there is a limited resources to educate and incentivize stakeholders to become CE. Higher production

costs, especially in using organic and regenerative farming crops, are a significant challenge for food-tech MSEs that want to remain competitive in the market. Restricted logistics networks and fragmentation in the supply chain make it difficult to coordinate and integrate the different stages of the chain to adopt CE practices. Overall, the implementation of CE principles in the food-tech supply chain faces many challenges that require collaborative efforts from all stakeholders involved, which have been found in previous research as Khan et al. (2021); Kok et al. (2019).

Implementing circular practices across all business operations can be a challenge for many companies, which often leads to a focus on specific areas. This could be due to the difficulty of scaling up pilot projects, resulting in only a small portion of the operation adopting CE principles. Despite this, even incremental improvements and changes can make a significant difference and help businesses move closer to their CE goals (Van Opstal & Borms, 2023).

Advanced technologies and innovation are essential for promoting sustainable food systems. As several authors agreed that technological innovation can help to increase efficiency, reduce waste, and improve the environmental performance of food production and distribution systems (Antikainen & Valkokari, 2016).

To foster an innovation network that supports entrepreneurs in various stages of venture creation, it is essential to incorporate diverse elements that facilitate knowledge sharing. This can involve bringing together individuals from different backgrounds, industries, and areas of expertise to exchange ideas and collaborate (Spender et al. 2017). By creating a platform that encourages the exchange of CE knowledge, entrepreneurs can gain access to valuable insights and resources that can help them grow their ventures. Additionally, incorporating elements such as mentorship programs and networking events can also provide nascent entrepreneurs with the support and guidance they need to succeed (Kohler, 2016).

Consideration of governance and legislation ambiguity can lead to fragmentation of sustainable practices instead of effective systemic solutions embracing tools as CE practices as the best way to achieve sustainability. The presence of hazardous materials and waste in the food system can pose significant risks to human health and the environment. To mitigate these risks, political decisions are necessary to manage these materials and waste at international level (Korley et al. 2021). One approach to reducing the amount of plastic waste in the food system

is through the implementation of quotas for plastic recycling and restrictions on harmful substances (Zarba et al. 2021; Testa et al. 2022).

Zarba et al. (2021) proposes a reevaluation of the CE system, emphasizing the convergence of the eco-economy and integrated territorial agri-food paradigm towards a shared objective. To promote circularity measures across various supply chains, the agri-food sector would benefit from targeted legislative guidelines. However, the existing policy interventions in this sector have been inadequate and lacking in clarity, impeding its effectiveness (Testa et al. 2022).

Maintain technical feasibility and environmentally sound threshold levels in these processes to ensure that hazardous materials are effectively managed while minimizing environmental pollution (Testa et al. 2022). As Kumar et al. (2019) and Giorgi et al. (2022) agreed policymakers must understand which business model features promote sustainability and implement operational, behavioural, and policy interventions accordingly. Effective policies can transform stakeholder behaviour and impact both individual firms and broader industrial systems through regulation, legislation, taxation, education, and incentives.

5.2. Towards an explanatory model of MSE's challenges related with CE in the value chain

The implementation of CE practices in food-tech SEMs is accompanied by numerous external and internal challenges. Entrepreneurs must overcome external challenges, such as consumer resistance due to sociocultural barriers that are often linked to restrictive and ambiguous legislation. In particular, unclear legislation can make it challenging for MSEs to navigate the CE market and result in reduced demand, lack of subsidies and external help.

Internal challenges are mainly dominated by the sourcing of raw materials, which affects the supply chain, creating a higher degree of complexity. Innovations and technology are essential components in the success of CE-based ventures. Therefore, incorporating innovation and technology in the sourcing of raw materials is necessary for the efficient functioning of the supply chain. Despite the European Commission's sustainability programs, there is a lack of knowledge and understanding of CE practices. Education and awareness-raising initiatives are crucial to drive demand for CE products and enable companies to implement CE strategies more easily.

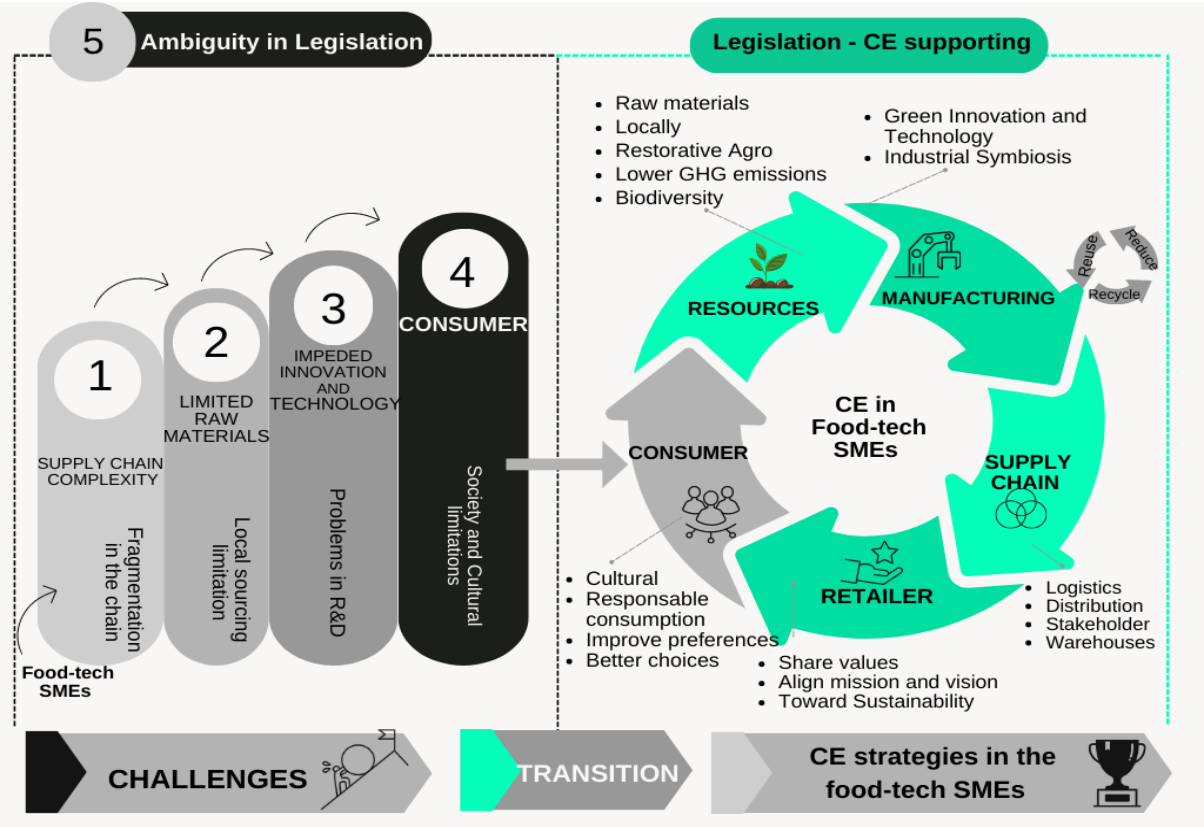


Figure 5.2 Transitioning to a circular food economy framework, key actions to success by the new venture creations from the entrepreneurial ecosystem
Source: By Author

Therefore, a comprehensive understanding of the challenges in the CE adoption model is crucial for food-tech MSEs to achieve their sustainability goals. This conceptual framework in Figure 5.2 provides insights into the challenges faced by entrepreneurs in the CE adoption model. It highlights the importance of collaboration, innovation, and technology in achieving sustainable strategies in the CE. The framework (Figure 5.2) identifies the areas that require attention to achieve circularity, including sourcing raw materials and the potential for waste upcycling. The proper disposal of materials is a critical component of the process, which can be accomplished through techniques such as energy generation, composting, or anaerobic digestion. The framework's dotted box defines the limits of circularity and considers external factors such as consumers and legislation, which can impact the system. Achieving a CE requires the involvement of the entire supply chain, from manufacturers to retailers. Their contribution is essential in implementing circular practices across the product's life cycle, starting from design to disposal. The framework guides the necessary steps towards achieving circularity, overcoming the challenges the supply chain, retailers, and manufacturing pose.

6. CONCLUSIONS

Food-tech MSEs in Sweden encounter both internal and external challenges in implementing CE practices. External challenges include unclear regulations and resistance from consumers who may be unwilling to pay more for CE products. On the other hand, limited raw materials are the main internal challenge for MSEs committed to CE, affecting innovation, technology, and the entire supply chain. However, there is potential to utilize waste from the food supply chain as a new material source for CE products. Additionally, restorative agricultural practices are crucial for CE and could be facilitated through industrial symbiosis. To overcome these challenges, MSEs need to devise effective strategies to educate consumers, build trust, and promote the widespread adoption of CE practices.

It was evidenced that some food-tech systems have shown greater adaptability in implementing CE systems than others, such as those producing organic, locally sourced, novel ingredients, plant-based food, fermented beverages, supplements, and edible packaging materials. The integration of sustainability into those business models has required a holistic approach. Given the complexity of the food supply chain, CE strategies could be applied to varying degrees in some or all parts of the chain. However, the entire business model must be governed by the same values and goals. Mutual contribution and collaboration are crucial to achieving joint development within the internal entrepreneurial ecosystem, education, policymakers, distributors, retailers, and consumers.

The new finding sheds light on the unique challenges faced by food-tech MSEs in Sweden when adopting CE strategies. While financial barriers may not be significant obstacles, this study emphasizes the importance of understanding MSEs' specific needs and challenges in their efforts towards sustainability. Policymakers and entrepreneurs can use these findings to design tailored programs and support mechanisms that address the specific challenges of MSEs in Sweden and promote an effective CE transition.

In conclusion, deliberate interaction, association, networking, and multiple learning activities are necessary to achieve a balanced system. Greater stakeholder engagement and increased trust and innovation in their business models are among the top changes companies need to make to pursue green and consumer-recognizable goals.

6.1. Implication for Research

This study presents a novel perspective on the challenges of CE strategies applied to MSEs food-tech in Sweden. In contrast to previous research conducted by Shahbazi et al. (2016) in Sweden and Rizos et al. (2016) in Europe, both identified a lack of financial resources, budget constraints, and high costs of eco-friendly materials as significant challenges, barriers, and enablers for MSEs. However, this study reveals that financing is not perceived as a significant challenge for MSEs to adopt CE strategies that will support their sustainability plans. Although lack of monetary resources is acknowledged as a general limitation for all entrepreneurial activities in this research, it is not perceived as a significant challenge for the participants.

It is important to highlight that the study's sample comprises a diverse group of MSEs in different stages of development, ranging from those that have not yet launched their first product to those that have been in business for several years and have diversified their portfolios and expanded their operations around Sweden and in Europe. To sum up, MSEs face challenges beyond funding and seeking capital. The external challenges posed by customers and regulations are of greater concern and relevance to the food-tech MSEs in this study.

On the other hand, the findings demonstrate that improved production models can be achieved by adopting CE practices. Therefore, it is desirable to increase the responsibilities and awareness of stakeholders, such as primary producers, legislators, entrepreneurs, and consumers, to incentivize the adoption of these practices in the whole foo-tech chain. However, this is still conceptually distant from current realities since sustainable and circular SEMs are a minority in Sweden.

The ultimate adoption of CE models needs to increase consumer acceptance of new food products made with previously "wasted" ingredients and CE resources. Implementing a CE is not always easy, as it often encounters biochemical, technological, innovative, market, and political challenges. However, success is still possible, as demonstrated by the "sustainable-born" SEMs that participated in this study, who shared part of the main insight of their journey towards sustainability while adopting CE strategies.

Finally, it has described from empirical evidence the challenges facing the food-tech system in relation to climate change, economic crises, and social problems. The CE stands out as an effective tool, but collaborations and alliances are essential.

6.2. Implications for Policymakers

Academics, decision-makers, and NGOs are just a few of the organizations that support the CE concept, which has recently received significant attention. However, despite its historical roots, CE remains a challenged and ambiguous concept, defined in various, sometimes contradictory ways. Rödl et al. (2022) examined public meetings and seminars in Sweden that aimed to promote the CE concept to business people and argued that ambiguity constitutes the CE discourse. The ambiguity is caused by whom and how CE is practiced; instead of focusing on "what is CE", it should be "how is CE talked about and done," highlighting the lack of clarity in effective strategies for CE adoption.

Other authors disagree with sustainable and CE policies for the food system, such as Eliasson et al. (2022), who contrasted the Swedish practitioner perspective with the European Commission regarding sustainable food systems. They emphasized that policymakers and practitioners must clearly agree on how food should be valued. The problematic issue is the *"lack of clarity as well as diversity of pathways to transform food systems."* Hjaltadóttir and Hild (2021) found that in sectors like the building industry in Sweden, stakeholders' lack of cooperation poses a significant barrier to adopting circular practices, especially among policymakers. They highlight the importance of transparency in addressing this issue, as it reduces fragmentation within the system. Policymakers should prioritize transparency in their policies to overcome these challenges and foster improved cooperation among stakeholders.

However, in Sweden, significant contributions have been made towards the possibility of having an industrial symbiosis, for instance, in Härnösand, with the aim to promote circularity and achieve sustainability, as expressed by Haller et al. (2022). They stated that pushing for policy changes is necessary, and Sweden plans to launch policy instruments that connect entrepreneurs and local governments to promote circular business models and industrial symbiosis; which is a wonderful opportunity to take real action.

Wasserbaur, Sakao, and Milios (2022), suggest an obligatory interaction between business model designers and policymakers to work together to force change in a bilateral dynamic in Sweden. An example is that the circular business model should understand policy frameworks and optimize their business model for them, and policymakers may support the circular business model's understanding of their specific needs. Both parties can improve policy and incentivize new ventures to follow circularity (Wasserbaur, Sakao, & Milios, 2022).

Therefore, the stakeholders with the greatest relevance are consumers (by demand), policymakers (by legislation), and businesses (by entrepreneurs), all of whom aim to generate change by adopting realistic and adaptable CE practices. Due to the complexity of each sector, laws must be specifically designed for each industry, taking into account trends and constant modernization, for instance, the growing demand for plant-based food and novel food alternatives. Currently, development and transformation are constants, and the adaptability of stakeholders will generate resilient food systems and any other sector that must transition towards sustainability.

6.3. Limitations of the study and research outlook

The findings of this study should be considered in the context of its limitations stemming from the small number of companies studied and the methods used. Conducting exclusive quantitative research on born-sustainable enterprises in the food tech sector in Sweden, using an inductive approach, has limitations. The absence of a comparison group and standardized measures hampers assessing unique contributions and challenges. Additionally, relying solely on quantitative research hinders establishing causal relationships, highlighting the need for a comprehensive mixed-methods approach. Future research should broaden the scope, include larger and more diverse samples, incorporate non-born-sustainable enterprises, and integrate quantitative measures alongside qualitative findings.

This study is specific to the Swedish context, known for its strong sustainability focus and supportive policies. The findings may not apply universally. Future research should explore MSEs challenges in different countries to validate and expand upon the study's findings in a diverse context. As Sweden has already made significant progress in this area, further research could help identify best practices for promoting circular BM and industrial symbiosis among different stakeholders in the food-tech supply chain.

On the other hand, it has been recognizing the need to research a quantitative study in areas of financial analysis that can assess the economic benefits of implementing CE practices, such as waste reduction, resource efficiency, and product life extension. This information empowers policymakers and micro and small enterprises owners to make informed decisions, effectively allocate resources, and implement circular economy strategies.

7. REFERENCES

Allal-Chérif, O., Climent, J.C. and Berenguer, K.J.U. (2023). Born to be sustainable: How to combine strategic disruption, open innovation, and process digitization to create a sustainable business. Journal of Business Research, 154, p.113379.

Bahari, S.F., (2010). Qualitative versus quantitative research strategies: contrasting epistemological and ontological assumptions. *Sains Humanika*, *52*(1).

Bell, E., Bryman, A. and Harley, B., (2022). *Business research methods*. Oxford university press.

Björk, V., & Matrsson, A. (2022). Institutional support for the internationalization of Swedish Small and Medium-Sized Enterprises: A Study of the Kalmar Region.

Bocken, N. M., De Pauw, I., Bakker, C., & Van Der Grinten, B. (2016). Product design and business model strategies for a circular economy. Journal of industrial and production engineering, 33(5), 308-320.

Bocken, N.M. and Short, S.W., (2020). Transforming business models: towards a sufficiency-based circular economy. In *Handbook of the circular economy* (pp. 250-265). Edward Elgar Publishing.

Borrello, M., Pascucci, S., Caracciolo, F., Lombardi, A., & Cembalo, L. (2020). Consumers are willing to participate in circular business models: A practice theory perspective to food provisioning. *Journal of Cleaner Production*, *259*, 121013.

Chen, H., Osman, A. I., Mangwandi, C., & Rooney, D. (2019). Upcycling food waste digestate for energy and heavy metal remediation applications. *Resources, Conservation & Recycling: X*, *3*, 100015.

Corvellec, H., Stowell, A.F. and Johansson, N. (2021). Critiques of the circular economy. Journal of Industrial Ecology, [online] 26(2). doi:https://doi.org/10.1111/jiec.13187.

Cullen, U. A., & De Angelis, R. (2021). Circular entrepreneurship: A business model perspective. Resources, conservation and recycling, 168, p.105300.

Cypress, B.S. (2017). Rigor or reliability and validity in qualitative research: Perspectives, strategies, reconceptualization, and recommendations. Dimensions of Critical Care Nursing, [online] 36(4), pp.253–263. doi:https://doi.org/10.1097/dcc.0000000000000253.

Dantas, T.E.T., de-Souza, E.D., Destro, I.R., Hammes, G., Rodriguez, C.M.T. and Soares, S.R., (2021). How the combination of Circular Economy and Industry 4.0 can contribute towards achieving the Sustainable Development Goals. *Sustainable Production and Consumption*, *26*, pp.213-227.

Eisenhardt, K.M. and Graebner, M.E., (2007). Theory building from cases: Opportunities and challenges. *Academy of management journal*, *50*(1), pp.25-32.

Eliasson, K., Wiréhn, L., Neset, T.S. and Linnér, B.O., (2022). Transformations towards sustainable food systems: contrasting Swedish practitioner perspectives with the European Commission's Farm to Fork Strategy. Sustainability Science, pp.1-15.

European Commission. (2020). New Circular Economy Action Plan. [online] Available at: https://ec.europa.eu/environment/circular-economy/pdf/new_circular_economy_action_plan.pdf [Accessed 8 February 2023].

FAO. (2018). Sustainable food systems. [online] Available at: https://www.fao.org/3/ca2079en/CA2079EN.pdf [Accessed on: 2023-02-08].

FAO. (2020). Animal Production and Health Division (NSA) Available online: http://www.fao.org/agriculture/animal-production-and-health/en/ [Accessed 28 January 2023]

FAO. (2021). FAOLEX Database [LEX-FAOC208661] Circular economy – Strategy for the transition in Sweden. Available online: https://www.fao.org/faolex/results/details/en/c/LEX-FAOC208661/ [Accessed 28 January 2023]

Foss, N.J. and Ishikawa, I. (2007). Towards a dynamic resource-based view: Insights from Austrian capital and entrepreneurship theory. Organization Studies, 28(5), pp.749-772.

Galli, F., Favilli, E., D'Amico, S., & Brunori, G. (2018). A transition towards sustainable food systems in Europe. *Food Policy Blue Print Scoping Study; Laboratorio di StudiRurali Sismondi: Pisa, Italy*.

Gedi, M. A., di Bari, V., Ibbett, R., Darwish, R., Nwaiwu, O., Umar, Z., ... & Foster, T. (2020). Upcycling and valorisation of food waste. In *Routledge Handbook of Food Waste* (pp. 413-427). Routledge.

Geissdoerfer, M., Savaget, P., Bocken, N. M. P., & Hultink, E. J. (2017). The Circular Economy – A new sustainability paradigm? Journal of Cleaner Production, 143, 757–768.

Genovese, A., Acquaye, A.A., Figueroa, A. and Koh, S.L. (2017). Sustainable supply chain management and the transition towards a circular economy: Evidence and some applications. Omega, 66, pp.344-357.

Giorgi, S., Lavagna, M., Wang, K., Osmani, M., Liu, G., & Campioli, A. (2022). Drivers and barriers towards circular economy in the building sector: Stakeholder interviews and analysis of five European countries policies and practices. *Journal of cleaner production*, *336*, 130395.

Govindan, K. and Hasanagic, M., (2018). A systematic review on drivers, barriers, and practices towards circular economy: a supply chain perspective. *International Journal of Production Research*, *56*(1-2), pp.278-311.

Guldmann, E., & Huulgaard, R. D. (2020). Barriers to circular business model innovation: A multiple-case study. Journal of Cleaner Production, 243, 118160.

Haller H, Fagerholm A-S, Carlsson P, Skoglund W, van den Brink P, Danielski I, Brink K, Mirata M and Englund O (2022) Towards a Resilient and Resource-Efficient Local Food System Based on Industrial Symbiosis in Härnösand: A Swedish Case Study Sustainability 14 2197 Online: http://dx.doi.org/10.3390/su14042197

Hamam, M., Chinnici, G., Di Vita, G., Pappalardo, G., Pecorino, B., Maesano, G. and D'Amico, M. (2021). Circular Economy Models in Agro-Food Systems: A Review. Sustainability, 13(6), p.3453. doi:https://doi.org/10.3390/su13063453.

Henry, M., Hoogenstrijd, T. and Kirchherr, J., (2022). Motivations and identities of "grassroots" circular entrepreneurs: An initial exploration. Business Strategy and the Environment.

Herrero, M., Thornton, P.K., Mason-D'Croz, D., Palmer, J., Benton, T.G., Bodirsky, B.L., Bogard, J.R., Hall, A., Lee, B., Nyborg, K. and Pradhan, P., 2020. Innovation can accelerate the transition towards a sustainable food system. *Nature Food, 1*(5), pp.266-272.

Hjaltadóttir, R.E. and Hild, P., (2021). Circular Economy in the building industry European policy and local practices. European Planning Studies, 29(12), pp.2226-2251.

Innovation, N. (2021). Data sharing for a circular economy in the Nordics. Available online: Saatavilla: https://www. nordicinnovation. org/CEdatasharing. [Accessed 21 February 2023].

Jurgilevich, A., Birge, T., Kentala-Lehtonen, J., Korhonen-Kurki, K., Pietikäinen, J., Saikku, L. and Schösler, H. (2016). Transition towards circular economy in the food system. Sustainability, 8(1), p.69.

Kahupi, I., Eiríkur Hull, C., Okorie, O., & Millette, S. (2021). Building competitive advantage with sustainable products—A case study perspective of stakeholders. Journal of Cleaner Production, 289, 125699.

Kalmykova, Y., Sadagopan, M. and Rosado, L. (2018). Circular economy–From review of theories and practices to development of implementation tools. Resources, conservation and recycling, 135, pp.190-201.

Khajuria, A., Atienza, V.A., Chavanich, S., Henning, W., Islam, I., Kral, U., Liu, M., Liu, X., Murthy, I.K., Oyedotun, T.D.T. and Verma, P. (2022). Accelerating circular economy solutions to achieve the 2030 agenda for sustainable development goals. Circular Economy, 1(1), p.100001.

Kirchherr, J., Reike, D. and Hekkert, M. (2017). Conceptualizing the circular economy: An analysis of 114 definitions. Resources, conservation and recycling, 127, pp.221-232.

Kohler, T. (2016). Corporate accelerators: Building bridges between corporations and startups. Business horizons, 59(3), 347-357.

Korley, L. T., Epps III, T. H., Helms, B. A., & Ryan, A. J. (2021). Toward polymer upcycling—adding value and tackling circularity. Science, 373(6550), 66-69.

Kumar, M., Raut, R.D., Jagtap, S. and Choubey, V.K. (2022) Circular economy adoption challenges in the food supply chain for sustainable development. Business Strategy and the Environment.

Kumar, V., Sezersan, I., Garza-Reyes, J. A., Gonzalez, E. D., & Al-Shboul, M. D. A. (2019). Circular economy in the manufacturing sector: benefits, opportunities and barriers. *Management decision*, *57*(4), 1067-1086.

Lehnert, K., Craft, J., Singh, N. and Park, Y.H., (2016). The human experience of ethics: A review of a decade of qualitative ethical decision-making research. *Business ethics: A European review*, *25*(4), pp.498-537.

Leshem, S. and Trafford, V., 2007. Overlooking the conceptual framework. *Innovations in education and Teaching International*, *44*(1), pp.93-105.

Lewandowski, M., (2016). Designing the business models for circular economy—Towards the conceptual framework. Sustainability, 8(1), p.43.

Liu, Z., Adams, M., & Walker, T. (2018). Are exports of recyclables from developed to developing countries waste pollution transfer or part of the global circular economy? Resources, Conservation and Recycling, 136, 22–23.

Lugo, S.D.R., Kimita, K. and Nishino, N. (2023) Characteristics of decision process towards Circular Food Economy: A review. Cleaner Logistics and Supply Chain, p.100104.

Magnani, G. and Gioia, D., (2023). Using the Gioia Methodology in international business and entrepreneurship research. *International Business Review*, *32*(2), p.102097.

Malik, A., Sharma, P., Vinu, A., Karakoti, A., Kaur, K., Gujral, H.S., Munjal, S. and Laker, B., (2022). Circular economy adoption by SMEs in emerging markets: Towards a multilevel conceptual framework. *Journal of business research*, *142*, pp.605-619.

Merriam, S. B., & Tisdell, E. J. (2015). *Qualitative research: A guide to design and implementation*. John Wiley & Sons.

Meticulous Research. (2021). Europe Plant-based Food Market by Product Type (Beverages, Dairy Alternatives, Meat Alternatives, Snacks & Bakery), Source (Soy, Almond, Pea, Rice, Others), and by Region - Global Forecast to 2027. [Market Research Report]. Available

online:https://www.meticulousresearch.com/product/europe-plant-based-food-market-5260 [Accessed 28 January 2023].

Muscio, A. and Sisto, R. (2020). Are Agri-Food Systems Really Switching to a Circular Economy Model? Implications for European Research and Innovation Policy. Sustainability, 12(14), p.5554. doi:https://doi.org/10.3390/su12145554.

Närvänen, E., Mattila, M. and Mesiranta, N., (2021). Institutional work in food waste reduction: Startups' role in moving towards a circular economy. Industrial Marketing Management, 93, pp.605-616.

Nguyen, A.T., Parker, L., Brennan, L. and Lockrey, S., (2020). A consumer definition of eco-friendly packaging. *Journal of Cleaner Production*, *252*, p.119792.

Nguyen, S., Choi, H.K., Lustig, R.H. and Hsu, C.Y., (2009). Sugar-sweetened beverages, serum uric acid, and blood pressure in adolescents. *The Journal of pediatrics*, *154*(6), pp.807-813

Pakseresht, A., Yavari, A., Kaliji, S.A. and Hakelius, K. (2022) The intersection of blockchain technology and circular economy in the agri-food sector. Sustainable Production and Consumption.

Pannila, N., Jayalath, M.M., Thibbotuwawa, A., Nielsen, I. and Uthpala, T.G.G., (2022). Challenges in Applying Circular Economy Concepts to Food Supply Chains. *Sustainability*, *14*(24), p.16536.

Paparella, A., Vecchio, R., Cembalo, L., & Lombardi, A. (2023). Measuring consumer effort in circular economy initiatives in the food domain: An exploratory analysis. *Heliyon*, *9*(2).

Peschel, A.O. and Aschemann-Witzel, J., (2020). Sell more for less or less for more? The role of transparency in consumer response to upcycled food products. *Journal of Cleaner Production*, *273*, p.122884.

Potter, H.K. and Röös, E. (2021). Multi-criteria evaluation of plant-based foods–use of environmental footprint and LCA data for consumer guidance. Journal of Cleaner Production, 280, p.124721.

Rajput, S. and Singh, S.P., (2019). Connecting circular economy and industry 4.0. *International Journal of Information Management*, *49*, pp.98-113.

Re, B. and Magnani, G. (2022). Value co-creation in circular entrepreneurship: An exploratory study on born circular SMEs. Journal of Business Research, 147, pp.189-207.

Rizos, V., Behrens, A., Van der Gaast, W., Hofman, E., Ioannou, A., Kafyeke, T., Flamos, A., Rinaldi, R., Papadelis, S., Hirschnitz-Garbers, M. and Topi, C., (2016). Implementation of circular economy business models by small and medium-sized enterprises (SMEs): Barriers and enablers. *Sustainability*, *8*(11), p.1212.

Rödl, M.B., Åhlvik, T., Bergeå, H., Hallgren, L. and Böhm, S., (2022). Performing the Circular economy: How an ambiguous discourse is managed and maintained through meetings. Journal of Cleaner Production, 360, p.132144.

Schebesta, H., & Candel, J. J. (2020). Game-changing potential of the EU's Farm to Fork Strategy. *Nature Food*, *1*(10), 586-588.

Shahbazi, S., Wiktorsson, M., Kurdve, M., Jönsson, C. and Bjelkemyr, M., (2016). Material efficiency in manufacturing: Swedish evidence on potential, barriers and strategies. *Journal of Cleaner Production*, *127*, pp.438-450.

Sharma, N.K., Govindan, K., Lai, K.K., Chen, W.K. and Kumar, V. (2021) The transition from linear economy to circular economy for sustainability among SMEs: A study on prospects, impediments, and prerequisites. Business Strategy and the Environment, 30(4), pp.1803-1822.

Sharma, Y.K., Mangla, S.K., Patil, P.P. and Liu, S. (2019) When challenges impede the process: For circular economy-driven sustainability practices in food supply chain. Management Decision.

Spender, J. C., Corvello, V., Grimaldi, M., & Rippa, P. (2017). Startups and open innovation: a review of the literature. European Journal of Innovation Management, 20(1), 4-30.

Suchek, N., Ferreira, J. J., & Fernandes, P. (2022). A review of entrepreneurship and circular economy research: State of the art and future directions. Business Strategy and the Environment, 31(5), 2256-2283.

Swedish Board of Agriculture. (2021). Swedish National Pathway for Sustainable Food Systems. [PDF] Jönköping: Swedish Board of Agriculture. Available at: https://summitdialogues.org/wp-content/uploads/2021/09/Swedish-National-Pathway-for-Sustainable-Food-Systems-Final.pdf [Accessed 4 May 2023].

Szilagyi, A., Cioca, L. I., Bacali, L., Lakatos, E. S., & Birgovan, A. L. (2022). Consumers in the circular economy: A path analysis of the underlying factors of purchasing behaviour. *International Journal of Environmental Research and Public Health*, *19*(18), 11333.

Takacs, F., Brunner, D. and Frankenberger, K. (2022). Barriers to a circular economy in small- and medium-sized enterprises and their integration in a sustainable strategic management framework. Journal of Cleaner Production, 362, p.132227. doi:https://doi.org/10.1016/j.jclepro.2022.132227.

Testa, S., Nielsen, K.R., Vallentin, S. and Ciccullo, F., (2022). Sustainability-oriented innovation in the agri-food system: Current issues and the road ahead. *Technological Forecasting and Social Change*, *179*, p.121653.

The Ellen MacArthur Foundation (2012). Towards the Circular Economy: Economic and Business Rationale for an Accelerated Transition. Available at. https://www.ellenmacarthurfoundation.org/assets/downloads/publications/Ellen-MacArthurFoundation-Towards-the-Circular-Economy-vol.1.pdf.

Van Opstal, W. and Borms, L., (2023). Startups and circular economy strategies: Profile differences, barriers and enablers. *Journal of Cleaner Production*, p.136510.

Vanhuyse, F., Rezaie, S., Englund, M., Jokiaho, J., Henrysson, M., & André, K. (2022). Including the social in the circular: A mapping of the consequences of a circular economy transition in the city of Umeå, Sweden. Journal of Cleaner Production, 380, 134893.

Velenturf, A.P. and Purnell, P., (2021). Principles for a sustainable circular economy. Sustainable Production and Consumption, 27, pp.1437-1457.

Vinnoova. (2022). FFI Circularity Available online: https://www.vinnova.se/en/m/strategic-vehicle-research-and-innovation/sub-programmes-and-strategic-initiatives/circularity/ [Accessed 24 January 2023]

Wasserbaur, R., Sakao, T. and Milios, L., (2022). Interactions of governmental policies and business models for a circular economy: A systematic literature review. Journal of Cleaner Production, 337.

Xu, X., Sharma, P., Shu, S., Lin, T.S., Ciais, P., Tubiello, F.N., Smith, P., Campbell, N. and Jain, A. (2021). Global greenhouse gas emissions from animal-based foods are twice those of plant-based foods. Nature Food, 2(9), pp.724-732.

Yin, S., Jia, F., Chen, L. and Wang, Q. (2023) Circular economy practices and sustainable performance: A meta-analysis. Resources, Conservation and Recycling, 190, p.106838.

Zarbà, C., Chinnici, G., La Via, G., Bracco, S., Pecorino, B. and D'Amico, M., 2021. Regulatory elements on the circular economy: Driving into the agri-food system. *Sustainability*, *13*(15), p.8350.

Zucchella, A. and Previtali, P. (2019) Circular business models for sustainable development: A "waste is food" restorative ecosystem. Business Strategy and the Environment, 28(2), pp.274-285.

8. APPENDIX

Appendix A: Interview guide

1. Background of the interview person and business
1. Your educational background, work experience and work function **2.** What is the core value proposition of your sustainable business model? (Explain what the company does, for example the produce plant-based cheese….) **3.** How many employees are in total right now? **4.** What have been the main challenges of your start-up? **5.** Are you aware of sustainable business model and circular economy, circularity, and green entrepreneurship? Does it apply in your business model
2. Supply chain
1. Where do you manufacture your products? **2.** Where do you source your raw materials and supplies? *If you import from outside of Sweden:* **3.** Do you use any raw material from other line that is consider "waste" to upcycle? **4.** What are the main reasons for you to import raw materials? **5.** Have you considered local raw materials? What are the challenges? **6.** How do you transport your final products to the distributors or buyers?
3. Operations
1. Key activities of your business model? (i.e., Your produce by yourself, did you have your own shop to sell,) **2.** Which are the sources of energy supplies to your facility? Are they alternative sources of energy such as wind or solar? How do you plan to improve them, for example, energy sources and water supply? (Solar panel, solar heating, wind energy, biomass system, smart manufacturing process, digitalization.
4. Marketing strategy
1. Who are your target customers and niche market? Which channel you use more in your marketing strategy social media? **2.** Is the price of your product in the range of the competitors' products? **3.** Do you have any sustainable or "green" label such as ECO, Krav, Fair trade, organic (EKO in Swedish), and Keyhole? **4.** Have you calculated the climate footprint of your products? **5.** Do you advertise the sustainability aspect of your product?
5. Waste management
1. How do you currently handle food/water waste produced by your facility? How effective are they?
6. Packaging
1. Do you use reusable, recycle or recycled packaging materials? If not, have you considered it and what are the challenges?
7. Next steps towards Circularity
1. Do you have sustainability plan or key initiative for the next 2-3 years? **2.** Do you plan to get any certification like B Corp certificate (high standards of verified performance, accountability, and transparency on factors from employee benefits and

charitable giving to supply chain practices and input materials.) or perhaps to calculate your total carbon footprint emissions as a company?

APPENDIX B. Supplementary quotation

Aggregate dimension from Second order Themes and First-Order categories	Representative Quotations
Consumer resistance to CE products	"You need to have the right team, who comprehend the trends on the market, understand the market and why they will buy your product and not the competitors. It is essential to reflect that you know what you are talking about to convince investors" (Ahrne, 2023) "we cannot limited our market to only Vegan, vegetarian or plant-based diet, our product is for everyone for flexitarian and for people who is worry about environmental impact from their food and beverages consumption, otherwise people will misunderstand" (Ahrne, 2023) "you need to present the information about sustainability and circularity in the way people understand and it is easy to explain, most people do not understand the symbols, people needs to be more educate by videos, marketing strategy and publicity" (Tendler, 2023) " the answer from the market is very positive since many people is lactose intolerant, religious reason, gluten allergies and for environmental reason , however it is still minority, and animal based food is the main election of the customer, the demand is growing steady" (Skavén Ruben, 2023) "when our products are in the shelf market people still prefer to choose Coca-Cola and soda drinks, instead to healthier drinks and with better environmental impact as Kombucha has, perhaps as cultural decision and neophobia to try something new" (Von Arnold, 2023) "our product is more expensive compare to the competitors from animal-based, our packaging is glass but it is reusable, once the customer buy the first time then they will need to buy the refill, and it will be cheaper" (Read, 2023)
Limited raw materials	"When we live in a climate like in Sweden we must have some raw materials that comes from abroad as black pepper, however we try to prioritize the main ingredients from Nordic countries" (Ahrne, 2023) "It is a big trend that the products have the Swedish flag, the consumer and retail ask for resource locally and produce in Sweden" (Ahrne, 2023) "processed food is aim to produce tasty, delicious, nutritious and good shelf - life" (Mustafa, 2023) " the customer in restaurant has high preference for drinks in glass bottle and connect glass with a premium and more expensive product" (Lagerstedt, 2023) "our bottle of glass in Sweden are recycling, but they are not reusable since the logistics in Sweden is quite challenges, however in Germany we plan to install a manufacturing and the glass bottles will be reusable" (Lehner, 2023) "we have minimal packaging materials, but they problem is the packaging is making not visible and highlight the product in the market compare to other brands, we are discussing to change the packaging to be more attractive to increase the sells" (Ahrne, 2023)
Supply chain complexity	"You need to have good contacts, retail in Sweden is crucial to have good contact with ICA" (Ahrne, 2023) "we avoid to use soy-based product however other companies used and their products are cheaper, however we know that soy bean is mostly imported from sensitive areas as Amazonas Brazil" (Ahrne, 2023)

	"in our supplier list of contact we need to have diverse options, prioritizing local produce, Nordic countries, however for cost and high volume we need to import raw materials for example from China to keep the price of product low" (Skavén Ruben, 2023) "to have key partnership with supplier, retailers and distributors is crucial, as well as align our values and common interest" (Mustafa, 2023)
Impeded Innovation and Technology	"We have two production facility we outsourced to produce, under our agreement and conditions" (Ahrne, 2023) "The process to find manufacturing producer was very difficult, because their values needs to be align with our sustainable vision" (Mustafa, 2023) "If we want to be successful we need to build our own facilities, but it is expensive, it require special conditions and it is not feasible to do as a single company, moreover to produce only for/by ourselves is not energy sourcing efficiency" (Mustafa, 2023) "the LCA studies and carbon foot print of the product and operations need financial resources that unfortunately is not easy for us to get as a start-up and small company, even we know our product in theory produce at least 50-80% less greenhouse gas emissions we cannot show it" (Tendler, 2023) "we need to create our own technology to make the extraction of the component in the raw materials, this is unique for us and we needed to invest in our line equipment and design new processing" (Lagerstedt, 2023) "we are aiming to create revolutionary dietary supplement with anti-cancer properties, and it is in phase of development, clinical trials and license, this process demand a huge capital investment, we also need to protect the intellectual property then it is many factors that are barriers in the development of nutraceutical and functional dietary supplement" (Read, 2023) "we have some product in lab scale, however to scale as industrial level we need the processing line and have our own equipment because we cannot outsource manufacturing due to the protection and confidentiality" (Read, 2023) "Our technology needs to be protected, process of patent require a lot legal advisors, financial source and several months to be complete" (Read, 2023) "we do not have good networking in academic sector to have more collaboration to develop good research" (Skavén Ruben, 2023)
Ambiguity in Legislation	"The European Union authorizes insects as food in 2021, as a safe ingredient, even if insects have been part of the different cultures diet from centuries like in Asia, it is just now to become legal to use it, this limited us in the past" "due to the novelty and lack of guidelines for insect and algae farm system, it is rare to find enough local suppliers in Sweden" (Tendler, 2023) "Unclarity of plant-based, vegan, vegetarian, flexitarian and other definition from the government make difficult to use a proper and general language in the marketing strategy to be direct and clear. It is needing uniformity and association" (Andersson, 2023) "the regulation is not updated to the needs to produce plant-based food with high nutritional content since the enrichment with vitamins and minerals is needed but not allow for organic food product label" (Ahrne, 2023)