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Developing and Scaling Up a Business for Upcycled Food Products: A Challenging Endeavour

By

Samuel Göransson

Elin Westberg

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Supervisor: Thomas Kalling

Abstract

Title: Developing and Scaling Up a Business for Upcycled Food Products: A Challenging Endeavour

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Authors: Samuel Göransson and Elin Westberg

Supervisor: Thomas Kalling

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Purpose: The purpose of the thesis is to examine challenges associated with developing and scaling up an upcycling business within the food industry, and how firms can handle these.

Theoretical Perspectives: The study is based on literature on business models and upcycling, including The Business Model Canvas by Osterwalder and Pigneur and previous literature on challenges and strategies associated with developing and scaling up an upcycling business within the food industry.

Methodology: To fulfill the purpose of the study, a multiple case of three companies was conducted. Also, external experts within the field of upcycling were consulted. The relationship between theory and the empirical data followed an abductive reasoning and the data was analyzed using thematic analysis.

Empirical Foundation: The empirical data consists of eight semi-structured interviews, five interviews with case company representatives, and three interviews with industry experts. The three case companies are all present within the food upcycling industry.

Conclusion: The study shows that upcycling firms encounter many different challenges throughout the process of developing and scaling up their business. Customer communication and supply chain management appear to be especially critical for upcycling companies to consider.

Keywords: Upcycling, Food industry, Side stream, By-product, Sustainability, Business growth, Product development, Commercialization, Scale-up, Circular economy

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Samuel Göransson

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1 Introduction

This chapter begins by describing the relevance of circular business models, and more specifically how business models that focus on upcycling of food waste can contribute to a more sustainable future. It is described that a transition to more circular business models, such as business models for upcycled food, has several benefits, but that there are several challenges in regard to their growth. The research field for upcycled food products is problematized, and after that, the purpose of the study is presented, as well as the research question it is intended to answer. The chapter concludes with an outline of the report.

1.1 Background

The global population is growing at a rapid rate and climate change is becoming an increasingly big problem, affecting regions worldwide (OECD, 2024). One of the main drivers of climate change is food production, responsible for around one-quarter of the world's greenhouse gas emissions (Srivastava et al. 2021). With global crop demand estimated to double between 2005 and 2050 (Tilman et al. 2011), the food industry risks putting increasing pressure on the planet and global food security (Jamaludin et al. 2022). Further expansion of cropland poses a significant threat to biodiversity and the environment (Molotoks et al. 2018) and to avoid this, there is a tangible need for food products and processes that make more efficient use of resources. One model of production and consumption that aims to extract maximum value out of resources by keeping them in the economic system for longer is the circular economy, recovering and regenerating products that would otherwise be disposed of (Elisha, 2020). Transitioning from a linear economy of 'make, use, dispose', to a circular economy is an integral part of sustainable development since it alleviates environmental pressures and enhances the security of primary raw material supply (Neves & Marques, 2022).

Within the framework of circular economy practices is the concept of upcycling (OECD, 2019), defined by Sung (2015) as the process of transforming a waste product of low value into something of higher value. About 30% of all food harvested is currently being wasted, which indirectly increases human-caused greenhouse gas emissions by 6% (Rakesh & Mahendran, 2024).

Upcycling of food waste is believed to be able to reduce food waste as well as greenhouse gas emissions (Bhatt et al. 2021; Jamaludin et al. 2022; Rakesh & Mahendran, 2024). By reducing waste and increasing resource use efficiency, food upcycling contributes to the United Nations' Sustainable Development Goals (SDGs), inter alia SDG 9.4 and SDG 12 (Rakesh & Mahendran, 2024; U.N. 2024). Researchers and industrialists therefore highlight the pressing need to integrate the process of upcycling within the food sector (Rakesh & Mahendran, 2024).

Companies worldwide are starting to offer food products made from upcycled ingredients and the market for upcycled food is expected to grow from \$52.4bn in 2021 to \$97bn in 2031 (Punia Bangar, 2024; Namkung, 2024). But, despite great possibilities to contribute value (Thorsen et al. 2022), the market for upcycled products is still immature, and Larsson (2018) highlights that the transition from a linear to a circular economy constitutes a significant challenge that will require multiple steps and changes. While the development of a circular economy may entail resource-saving and productivity gains in the long term, there is a substantial amount of resources required to initiate the transformation and build up the new system (Larsson, 2018). It will for example require significant changes to companies' value chains and business models, changing from linear models to business models based on circular flows (Rosa et al. 2019; Behnert et al. 2024). Companies that choose to adopt a circular business model will for example have to compete against streamlined, linear businesses, which are still dominating the global economy (Larsson, 2018). To be competitive they will need to offer more value for money compared to products produced through linear processes (Larsson, 2018) and in order to free financial resources, they will have to convince customers, investors, governments etc. about the advantages of a circular business model (Larsson, 2018).

There are in other words, despite benefits, many challenges associated with transitioning to circular business models, and since the term upcycled food has gained traction only in recent years (Zhang et al. 2021; Aschemann-Witzel et al. 2023), the agrifood industry remains underrepresented within the institutional framework of the circular economy (Gaëlle et al. 2022). To understand what challenges and possibilities a certain type of company has in terms of growth, it is required to research the specific company and its business model (Jansen et al. 2023). It is, therefore, necessary

to examine companies working with food upcycling to understand their unique challenges and how these can be managed, which will be key to transition to more sustainable food systems.

1.2 Problematization

In the last decade, there has been an increased interest worldwide in the environmental impact of products and processes, and sustainable use of natural resources (Rosa et al. 2019). As a result, scientific contributions within the field of circular economy have grown steadily (Kirchherr, 2023), and a recent development within the area of circular economy is the concept of upcycled foods (Cela et al. 2024). Despite upcycling of food being highlighted as an important part of a sustainable future and a promising approach to combat food waste by several researchers (Jamaludin et al. 2022; Bhatt et al. 2021; Aschemann-Witzel et al. 2023; Rakesh & Mahendran, 2024), there appears to be a scarcity of knowledge about how upcycling businesses can scale up their operations.

Zucchella and Previtali (2018) argue that scalability represents a significant challenge in regard to circular business models, limiting widespread adoption. Although most circular business model ideas fail to reach the market, knowledge about the challenges affecting specific firms and businesses still constitutes a significant research gap (Baldassarre & Calabretta, 2024). With a variety of business models existing within the circular economy, Zucchella and Previtali (2018) advocate for further investigation to gain insight into the different factors that drive or impede the growth of particular firms, and Caldera et al. (2022) highlight upcycling as an area that has received insufficient attention. Business models for upcycled products represent a specific business model subtype within the concept of circular business models focusing on resource recovery (OECD, 2019), and this thesis aims to focus on food upcycling specifically.

Donner et al. (2020) argue that challenges and opportunities associated with upcycling of food waste have received little attention from a socio-economic perspective but mostly been researched from a technological point of view. However, the authors argue that technological innovation by itself is not enough to guarantee the successful growth of circular businesses, but that new business models are required. Similarly, Aschemann-Witzel et al. (2023) claim that the main barriers to adopting a circular economy are not that much of a technological nature, but rather linked to the practices and perceptions of companies and customers. This underlines the relevance of further

research within the area of upcycled foods, where challenges and opportunities are examined not only from a technical perspective but also taking the whole business into account. Furthermore, examining which challenges are prominent in different phases of growing a food upcycling business could provide a more nuanced picture that illustrates how they differ depending on where the business is in its development.

1.3 Purpose and Research Question

Drawing on the background and problematization, the purpose of this thesis is twofold. First, it aims to contribute to academia by addressing the research gap addressed in the problematization. The problematization describes that there is a lack of research regarding the factors that drive or impede the growth of circular businesses, and food upcycling companies in particular. While previous research has focused on the technical challenges with food upcycling, this thesis intends to take a holistic approach and examine challenges in a number of areas, thus providing an overview of the socio-economic, environmental, and logistical factors impacting the growth of upcycling companies within the food industry. Moreover, it aims to contribute by describing what challenges are more prominent at different stages of growing the business, and how these can be handled. We also aim to address the relationship between the challenges and the company's business model: how the company's business model affects what challenges the company has, but also how the challenges affect how the company changes its business model over time.

Second, the thesis aims to contribute to practice. By identifying common challenges and potential solutions to growing an upcycled business within the food industry, it strives to assist companies in making more informed strategy decisions. The thesis aims to provide value both to existing food upcycling companies aiming to grow their business and to food companies that are not working with upcycling currently but are looking to adopt upcycling practices. Additionally, the thesis hopes to raise awareness of the environmental benefits of upcycling and encourage consumers, businesses, and policymakers to prioritize sustainable practices in the food industry.

To summarize, the purpose of the thesis is to explore what challenges are prominent when growing a business for upcycled food products, and how these can be handled. To investigate the matter, the following research question was formulated: What are the main challenges associated with

developing and scaling up a business for upcycled food products, and how can firms handle these? The research question will be explored by conducting a multiple case study of three different food upcycling companies which successfully launched an upcycled product on the market. Experts within the area of upcycling will also be consulted to increase the understanding of the research subject.

1.4 Outline of Thesis

After introducing the topic of the thesis in this first chapter, the rest of the thesis comprises five further chapters. In the thesis' **second chapter**, we present literature on business models and upcycling to establish a common understanding of these subjects. Based on previous literature, we compile challenges with growing a food upcycling business in six overarching areas. At the end of the chapter, we present the preliminary empirical framework that will be used to analyze the empirical data.

In the **third chapter**, we describe and motivate our methodological choices. The chapter begins with a description of the study's research approach and design. Following that, we describe how the data has been collected and analyzed. The chapter ends with a discussion of the study's validity and reliability, as well as ethical considerations.

In the **fourth chapter**, the empirical findings are presented. The chapter begins with a description of the case companies, followed by our result regarding which challenges and strategies were prominent in the different stages of growing an upcycled business within the food sector. The chapter concludes with our empirical framework, in which we have summarized our findings.

In the **fifth chapter** of the thesis, key findings will be discussed and put in relation to previous research. The chapter is divided into four sections. The first three sections discuss challenges and strategies in relation to three different stages of growing a business and the last section addresses the connection between challenges and strategies, and the company's business model.

The **final chapter** of the thesis presents the theoretical and practical implications of the research. We will also address limitations of the study and offer suggestions for future research.

2 Literature review

The first part of this chapter focuses on business models, opening with a general description of the research field, to then describe the Business Model Canvas by Osterwalder and Pigneur. The second part of the chapter covers upcycling, placing it within the broader concept of the circular economy. The field of upcycled food is explained, followed by previous research on the challenges of developing and scaling up a business for upcycled food products, and how these can be handled. The chapter concludes with a description of the preliminary framework that will be used to conduct the empirical study.

2.1 Business Models

What challenges companies encounter, and how they handle them, to a large degree depends on how their business is configured. Therefore, to fully understand individual companies' challenges and possibilities, a common language describing the different parts of a business is required. For this purpose, we have chosen to integrate a business model perspective, which will be elaborated on in the following section.

2.1.1 Business Model Concept

The concept of business models has a history that stretches back to the late 1950s (Osterwalder et al. 2005), but it was not until the rise of the internet and the dot com bubble in the 1990s that the concept gained popularity (Andreini & Bettinelli, 2017; Wirtz, 2020). Up until the early 1990s, the term business model mostly appeared within the field of computer and system modeling, but during the 1990s other fields began to influence the understanding of the term (Wirtz, 2020). The term business model was for example increasingly used in a strategic context and many papers since the 2000s closely relate business models and strategy (Wirtz, 2020). Since the concept is complex and stems from diverse theoretical perspectives, there is no universally agreed-upon definition of the term (Shafer et al. 2005; Wirtz, 2020). However, many definitions share the understanding that a business model should describe how an entity creates, delivers, and captures value, thereby describing how the business is managed (Andreini & Bettinelli, 2017).

Over the past fifteen years, there has been a shift in business model research from static descriptions to a more dynamic approach, placing greater emphasis on the development and innovation of business models (Andreini & Bettinelli, 2017). While business models within the static approach are seen as a description or a blueprint of the important functions, the dynamic or transformational approach considers business models a concept or tool to emphasize innovation and change, either within the organization or the business model itself (Demil & Lecocq, 2010). According to Demil and Lecocq (2010), the two different uses of the concept, static and dynamic, should be seen as complementary, and Shafer et al. (2005) highlight that the creation of a company's business model is an iterative and constantly ongoing process. It is this view of business models, that they can be both static and dynamic, that will be adopted in this thesis. Changes to the business model may be influenced by both internal and external factors, where internal factors include management decisions or interrelations between core components of the business model, and external factors are changes in the environment in which the organization is operating (Demil & Lecocq, 2010).

Since a for-profit organization's survival and prosperity depend on its ability to create and capture value, an understanding of how to design and use business models is integral to ensuring the long-term success of an organization (Shafer et al. 2005). To be able to discuss and work with business models, a common understanding of the concept is needed. A recognized and well-established model is the Business Model Canvas framework (BMC) by Osterwalder and Pigneur (2010), which will be explained in the following paragraphs.

2.1.2 Business Model Canvas

Similar to many other authors, Osterwalder and Pigneur (2010) define business models as the way an organization creates, delivers, and captures value, and they describe the BMC as “a shared language for describing, visualizing, assessing, and changing business models” (p.12). The BMC consists of nine building blocks that will be elaborated on in the following paragraphs, using Osterwalder and Pigneur's (2010) book *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers*.

The first building block is **customer segments**, which is a central part of the BMC since a business cannot survive without customers. A company may group customers into segments, for example, based on their needs and behaviors, to better satisfy their needs. They must then make a conscious decision about which segments to focus on and which to ignore. Once the target group is selected, a business model can be built around a thorough understanding of the specific customer needs. There are several different types of customer segments, and a business model can range from not distinguishing between customer segments at all, serving a mass market, to targeting niche markets, with specialized customer segments that require different adjustments to the building blocks of the BMC. Customer segments can also include other businesses.

The **value proposition** is the aggregated value or benefits the company offers to customers, either by satisfying a need or by solving a problem. It is the reason customers choose one company over another. The value provided can be either qualitative, such as design or customer experience, or quantitative, such as price or speed of service. Some elements that can provide value for customers are improvements in product or service performance, satisfying a new type of need that was not met before, or customizing products and services to individual customers or customer segments. Displaying a certain brand can also provide customers with value in the form of status.

Channels refer to the way a company reaches out to its customer segments to deliver the value proposition, for example through communication, distribution, and sales channels.

Channels can be used for example to create awareness of the company and its offer and to deliver the value proposition to customers. The company can choose to either reach customers directly or indirectly through its own channels or to reach them indirectly through partner channels. To maximize revenues and create a good experience for customers, companies must find the right balance between the different types of channels. **Customer relationships** are the types of relationships a company establishes with different customer segments, with the purpose of for example acquiring or retaining customers, or boosting sales. The relationships can range from personal to automated, and companies can also use communities or co-creation to increase involvement from customers. The cash generated by a company from a specific customer segment is called **revenue streams**. To generate one or more revenue streams, companies need to consider for what value customers are willing to pay.

Key resources represent the assets that are most important for the business model to function. Resources can be financial, physical, intellectual, or human, and either be owned by the company or acquired from key partners. The type of business model determines what resources are needed. For the business model to work and to operate successfully, the company must also undertake certain **key activities**. Just like the key resources, the type of key activities depends on the business model type. The key activities can be associated with production, such as designing or delivering products, or solving individual customer problems.

Key partnerships refer to the network of essential partners and suppliers required for the operation of the business model. There exist several types of partnerships with different purposes. For example, forming alliances can reduce risk and uncertainty in a competitive environment, and relationships between buyers and suppliers can help optimize the allocation of resources and activities. Partnerships can be formed between both competitors and non-competitors, and by collaborating the company can acquire resources and activities that it does not have access to or have the possibility to perform by itself.

The most significant costs associated with the business model constitute the **cost structure**. A company's cost structure typically consists of a combination of fixed and variable costs. Companies with a low-price strategy are typically more price-sensitive than those providing quality products and services. Cost structures can be of different nature. Some companies experience cost benefits from economies of scale, which means that the cost per unit is reduced as the company's output expands. Other companies may benefit from economies of scope, which is when the company experiences advantages because of operations, such as marketing campaigns, being done on a larger scale. The BMC template seen in Figure 1 provides an illustration of the nine building blocks.

The Business Model Canvas

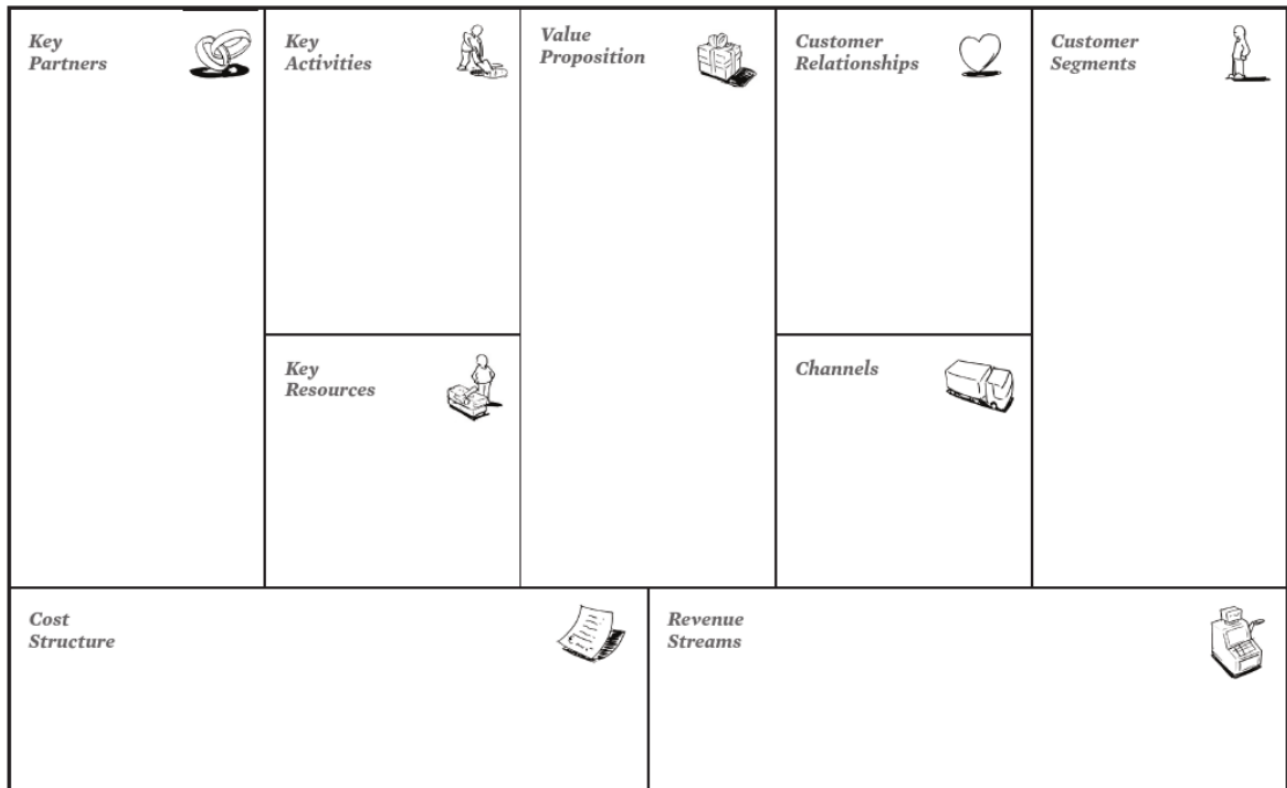


Figure 1. The Business Model Canvas Template (Osterwalder & Pigneur, 2010)

2.1.3 Sustainable Business Model Canvas

We will in our study use the BMC to develop an understanding of the upcycling companies’ business models. However, the BMC by Osterwalder and Pigneur has received criticism for not being suitable for mapping sustainable businesses since it focuses primarily on customer value, while sustainability requires a wider range of stakeholders to be considered (Gaëlle et al. 2022). This has led to expansions of the BMC, such as Cardeal et al. 's (2020) “Sustainable Business Model-Canvas”, integrating sociological and ecological aspects into each of the nine blocks in the framework, and taking a broader range of stakeholders into account. Although Osterwalder and Pigneur (2010) argue that the BMC can be applied to a wide range of firms they also put forward a suggestion to incorporate social and environmental aspects into the BMC for organizations that have a strong non-financial mission related to ecology or social aspects. Their suggestion is to introduce two additional building blocks to the BMC: social and environmental costs, and social and environmental benefits, where the purpose is to maximize positive impact and to limit the

negative impact. Based on the authors' discussions we recognize the importance of including social and environmental aspects when studying sustainable businesses.

2.1.4 Three Stages of Growing a Business

The purpose of this thesis is to investigate which challenges are prevalent in the different stages of growing a food upcycling business. The three stages that will be examined are product development, commercialization, and scaling up. These will be described in the following paragraphs.

Product development is often a gradual process, starting off with an idea (Schuh et al. 2020) to then evolve into verbal and visual descriptions that require multiple revisions before reaching the formal technical definition of the product (Mattson & Sorensen, 2020). What the product development process looks like is highly dependent on the actions taken by the person or the team developing the products, and largely requires adaptation based on the product in question (Mattson & Sorensen, 2020). For product development to be successful, Mattson and Sorensen (2020) highlight two aspects that are particularly important for the developing team to have in mind: that the product is desirable to the market and transferable to the production system through a clear and complete design. These parts are described by the authors as necessary for the product to be manufactured and sold on the market.

Schuh et al. (2020) describe that an innovation is realized through successful market implementation. However, **commercializing** new products is fraught with challenges (Greenstein, 2024) and most ideas do not achieve market success, even though they were perceived as promising during the design phase (Schuh et al. 2020). For a successful product launch, the company must gain market acceptance and overcome initial resistance and skepticism towards the product (Greenstein, 2024). The next step is to **scale-up** the business. This can be done in different ways and the preferred method depends largely on the product in question. Begimkulov and Darr (2023) mention that while there are differences between scaling out, scaling up, and scaling deep, the concepts are vaguely defined and many research articles that use the term scaling up actually deal with scaling out (Begimkulov & Darr, 2023). Due to this ambiguity, we will in this essay not make a distinction between the different types of scaling but use scaling up as a collective name

for all forms of growth taking place after the product has been commercialized. Some common ways of growing a business are by expanding geographically, stimulating market demand, increasing the product offering, or increasing the scope or intensity of the offering through collaborations and partnerships (Begimkulov & Darr, 2023).

2.2 Upcycling

2.2.1 Upcycling as a Part of the Circular Economy

Since upcycling is a practice that is often fitted into the broader concept of circular economy (Caldera et al. 2022; Aschemann-Witzel et al. 2023), it is relevant to begin by describing the theoretical background of circular economy, before going deeper into the area of upcycling.

The concept of circular economy was introduced at the end of the 1980s, however, it is mainly in recent years that it has increased in relevance (Rosa et al. 2019). Drawing inspiration from the closed-loop economy, the circular economy is a model of production and consumption aimed at preserving the value of products and resources within the economic system for as long as possible by adopting circular systems of production and consumption (Merli et al. 2018; Ghosh, 2020). Prior to the introduction of the circular economy, the prevailing paradigm was that of a linear, open-ended economy (Rosa et al. 2019). Within this linear economy, the pattern of production and consumption adhered to a make-use-dispose approach (Neves & Marques, 2022), lacking any inherent inclination toward recycling (Su et al. 2013). Successively, these linear models have been replaced by closed-looped systems to better meet environmental, social, and economic needs (Rosa et al. 2019). Nevertheless, the circular economy has received criticism for not paying sufficient attention to business and economic perspectives, thus limiting widespread implementation of circular practices (Lieder & Rashid, 2017).

Within the circular economy is the concept of upcycling, a term that dates back to the early 1990s but has gained traction in research during the last 15 years and become an important part of sustainable development (Sung, 2015; Gaëlle et al. 2022). The expression upcycling commonly refers to the process where a waste product of low value is transformed into something of higher value (Sung, 2015). Upcycling is closely related to the more commonly known word recycling,

which also refers to utilizing materials that otherwise would have been wasted (Aschemann-Witzel et al. 2023). Recycling on the other hand often entails a downcycling of the product i.e. a loss of value from the original product (Braungart et al. 2015), whereas upcycling entails adding value to the waste product (Aschemann-Witzel et al. 2021). Due to the added value to low-value material, upcycling is considered a more desirable alternative compared to recycling (Oyenuga & Bhamidimarri, 2017). In literature, the value-adding process is often referred to as valorization of waste products, side streams, or by-products (Aschemann-Witzel et al. 2021).

2.2.2 Upcycled Food

Upcycling has gained traction in several industries, such as the fashion and textile industry, the construction industry (Sung, 2015), and more recently the food industry (Aschemann-Witzel et al. 2023). Aschemann-Witzel et al. (2023) highlight that using all parts of food is not a new phenomenon, but that it has been prevalent historically in times of scarce resources. However, both the industrialization of food production and shifting consumer perceptions have contributed to the current issue of large amounts of underutilized and wasted food throughout the whole value chain (Aschemann-Witzel et al. 2023). Because of these issues, and an increased awareness about the environmental impact of food production, the importance of using the whole resource has been reemphasized (Aschemann-Witzel et al. 2023). Aschemann-Witzel et al. (2023) have compiled three necessary elements that need to be fulfilled for a food product to be considered an upcycled food product. The first criterion is that it consists of, or contains, materials that would otherwise be wasted. Second, it has to be turned into a food product for human consumption, and third, this process has to involve an increase in value. For the purpose of this study, we will adopt this definition of upcycled food products.

A main constituent of an upcycled product is that it originates from a food ingredient that otherwise would have been wasted (Aschemann-Witzel et al. 2023). In some parts of the literature a distinction is made between food loss and food waste, whilst other articles use the terms interchangeably or use the term food waste exclusively to address both types. One definition of the difference is based on where in the value chain the waste can be derived from. Food loss occurs in the production, postharvest, and processing stages, whereas food waste occurs at the end of the value chain from retailers and consumers (Upcycled Food Association, 2020). To avoid confusion

due to inconsistent use of the terms in previous literature, the term food waste in this paper will refer to both food waste and food loss unless further detail of the origin of waste is stated.

Aschemann-Witzel et al. (2023) argue that a necessary constituent of an upcycled product is that the raw material is still commonly wasted. One example is Whey, which is a by-product of dairy production, that has turned into an attractive protein source used in protein powders, and therefore might soon no longer be regarded as an upcycled product (Aschemann-Witzel et al. 2023). Another example is hot dogs which initially were created from left-over meat trimmings and thus would have fulfilled the criteria for an upcycled product, but no longer does since this process of using meat trimmings has become regular practice (Upcycled Food Association, 2020). This has two implications: first, there is an innovative element to upcycling food products, and second, what is considered waste is largely based on public perception (Aschemann-Witzel et al. 2023).

The inverted waste hierarchy pyramid first developed by the EU within Directive 2008/98 “On waste and repealing certain directives” (Directive 2008/98) has seen iterations by several authors and in recent years been adapted to address the management of food waste specifically (Papargyropoulo et al. 2014; Moshtagian et al. 2021). A recent adaptation of the model by Moshtagian et al. (2021) states that prevention of food waste followed by redistribution of food sources are the most preferable solutions in terms of sustainable food waste management (Moshtagian et al. 2021). Although upcycling adds value to otherwise wasted foods, the new product likely requires additional resources and energy compared to redistribution, and if the food industry could prevent food waste there would be no need for upcycling. However, Moshtagian et al. (2021) illustrate that upcycling of food waste is considered a better option than many other alternatives lower down in the food waste management hierarchy, including animal feed reuse, composting, and energy recovery (see Figure 2 below). It is thus these alternatives that should be considered for upcycling. However, case-to-case assessments are necessary as some types of food waste are not suitable for human consumption or require resource-intensive upcycling processes, diminishing the marginal utility of the upcycled product (Moshtagian et al. 2021), which directly connects to the value-adding part of the definition for upcycled food products (Aschemann-Witzel et al. 2023).

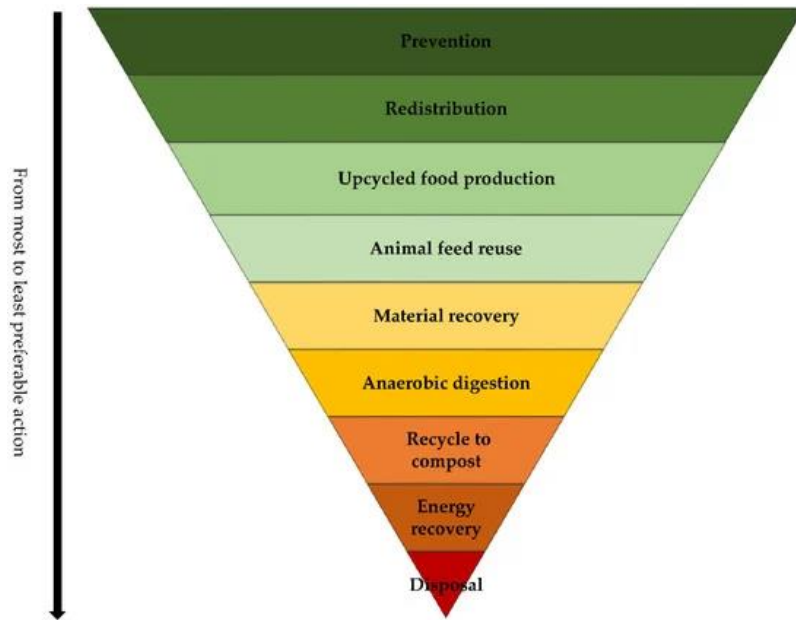


Figure 2. Food Waste Management Hierarchy (Moshtaghian et al. 2021)

2.2.3 Challenges and Strategies with Upcycling of Food

Considering the relative recency of upcycled products there are still many challenges to overcome for upcycled food products to move beyond being regarded as a niche product category (Aschemann-Witzel et al. 2023). Based on the literature within the research topic and a study conducted by Salvatore et al. (2024), compiling factors to be considered for upcycled food products, we have identified six overarching themes of challenges for upcycled food products. We are aware that these six themes, and many of the individual challenges within these, intersect and impact each other, but we believe that some kind of structuring is necessary to gain an overview of existing literature. Thus, the themes are to be seen as sensitizing categories, providing the user with a general sense of direction, rather than definitive concepts (Blumer, 1954).

The main area of challenges addressed in literature is connected to customer perception and marketing of upcycled foods, which has been explored in several studies (Aschemann-Witzel & Peschel, 2019; Bhatt et al. 2020 Goodman-Smith et al. 2021; Zhang et al. 2021; Thorsen et al. 2022; Nyhan et al. 2023). Other areas of challenges within the upcycled food sector are technology, partnerships and collaborations, regulations and food safety, sustainability, and economic viability

(Salvatore et al. 2024). These six areas of challenges will be addressed in the following paragraphs, and we will also include what literature says about how the challenges can be overcome.

Customer Perception

As previously mentioned, there are several papers focused on the positioning of the firm and customer perception of upcycled food products. Rakesh and Mahendran (2024) highlight that consumers are the ultimate decider for the success of upcycled products, which explains why researchers have emphasized customer perception at this early stage. A study conducted on 1001 consumers in New Zealand showed that 69% were equally or more likely to purchase an upcycled food product than a conventional product if they were comparable in regard to price, taste, size, etc. (Goodman-Smith et al. 2021). However, only 12% of the respondents were prepared to pay a premium for upcycled foods, which indicates that upcycled foods need to become comparable in terms of price to extend beyond being a niche market (Goodman-Smith et al. 2021). Bhatt et al. (2020) drew similar conclusions from their study, which showed that consumers were less willing to pay for an upcycled product compared to a conventional food alternative. One reason for the lower willingness to pay is that using an otherwise wasted product is perceived by customers as the product being of lower quality, which should render a lower price (Bhatt et al. 2020; Nyhan et al. 2023).

However, customer education and communication of the benefits of upcycling have been shown to have positive effects on consumers' likelihood of purchasing upcycled foods (Goodman-Smith et al. 2021; Zhang et al. 2021) and their willingness to pay (Bhatt et al. 2020). Aschemann-Witzel and Peschel (2019) argue that convincing customers to try a novel product can be difficult and is a major task for firms entering this market. One way of reaching out to customers and creating awareness is through certifications and logos (Zhang et al. 2021; Thorsen et al. 2022). Certifications can contribute to educating consumers on what upcycling is and increase their confidence in the quality of the product (Zhang et al. 2021). Furthermore, different generations have various preferences and will likely require varying types of products and marketing channels (Zhang et al. 2021).

Technology

Valorization of side streams in many cases requires new technologies for harvesting, separation, and processing (Salvatore et al. 2024). For example, further processing may be needed to extract inedible parts or alter unwanted characteristics of the material (Rakesh & Mahendran, 2024). This is for example the case when upcycling apricot kernels (Akhone et al. 2022). New technologies often demand expensive investments into infrastructure and add to the complexity of the processing units (Salvatore et al. 2024).

Partnerships and Collaborations

A third area of challenges revolves around collaboration and partnerships. Donner et al. (2020) describe that a circular business model entails different types of corporations and partnerships compared to a business model based on linear flows. This in turn brings a number of challenges. In particular, Donner et al. (2020) highlight the challenge of waste and by-product collection as it implies costs in the form of quality monitoring and careful handling of the products, as well as variability in terms of volume and product specificity. The company also needs to establish long-term relationships with local farmers to ensure access to the by-product (Donner et al. 2020). Moreover, Augustin et al. (2020) and Aschemann-Witzel et al. (2023) emphasize that upcycling of food requires collaboration between multiple stakeholders across the entire value chain, including farmers, governments, agribusiness, and civil society. Aschemann-Witzel et al. (2023) describe that knowledge sharing across and between value chains is important for producers and processors to find new applications for food waste.

Reaching retailers will be a vital step for the upcycling industry going forward. (Thorsen et al. 2022). A study addressing how upcycled products can reach supermarket shelves found that retailers evaluate new products based on a customer perspective and through a vendor lens (Thorsen et al. 2022). The customer perspective entails that there is a demand for the product which may be difficult to argue for new firms entering the market since they lack data and will have to refer to the success of other similar products (Thorsen et al. 2022). Furthermore, retailers value reliability and consistency from their suppliers to ensure constant stock levels (Thorsen et al. 2022), which might pose a challenge for upcycling firms due to the problems with seasonality and irregular access to quality waste ingredients (Salvatore et al. 2024). These findings indicate that the early movers might have a challenging time, but as upcycled products grow in popularity and

prove themselves as a successful concept it will likely open the door for other upcycled products in the market (Thorsen et al. 2022).

Regulations and Food Safety

Another area that poses a challenge to the spread of upcycled foods is regulations and concerns regarding food safety. For upcycled food products to be sold on the market they need to meet certain criteria and comply with food safety regulations (Moshtaghian et al. 2021). Hagman (2023) describes that some processed food waste is not classified for human consumption, which thus constitutes a barrier to further development. Ensuring food safety can, however, be seen as a critical area for upcycled products. Augustin et al. (2020) describe that food waste such as fruits and vegetables is high in moisture, which makes them prone to deterioration and microbial spoilage. Appropriate infrastructure and handling the produce in a timely fashion is thus critical to reduce safety risks (Augustin et al. 2020). To ensure food safety and that appropriate practices regarding hygiene are being followed for upcycled food products, the authors call for a better regulatory framework and new analytical methods, such as blockchain.

Sustainability

Although the concept of utilizing by-products is favorable from a sustainability perspective, the practices and overall environmental impact of the production process needs to be accounted for (Salvatore et al. 2024). The origin of food waste, and where in the supply chain the food waste occurs, entails different challenges and considerations in regard to sustainability (Rakesh & Mahendran, 2024). Moreover, complex supply chains and transportation are prone to environmental concern (Aschemann-Witzel et al. 2021). Furthermore, Aschemann-Witzel et al. (2021) stresses that the social effect of upcycling also needs to be considered when assessing the overall sustainable impact of a product or firm. One way which the upcycling industry can have a positive social impact is by providing farmers and suppliers with an additional revenue stream (Donner et al. 2020; Aschemann-Witzel et al. 2021).

Economic Viability

Besides assessing the sustainable contribution, it is vital for firms to consider the economic viability of their product in order to establish themselves in the food industry. A study addressing

the potential of agricultural by-products in the EU showed that challenges related to seasonality, transportation costs, low market price and low quantities, impact the economic feasibility for valorizing and commercializing certain by-products (Bedoić et al. 2019). On the other hand, finding new uses for previously wasted products can provide actors in the food industry with new revenue streams or with cost savings (Sung, 2015). Furthermore, economic feasibility is closely related to the development of competitive business models, which Teece (2010) highlights is just as important as creating a competitive product.

2.3 Preliminary Framework

Based on the literature review, we could identify six main areas of challenges for scaling up a business model for upcycled foods: customer perception, collaborations and partnerships, regulations and food safety, sustainability, economic viability, and technology. The areas form the basis of our preliminary framework, seen in Figure 3, which will be used to answer this study's research question. The preliminary framework illustrates that growing a business encompasses three steps: product development, commercialization and scaling up, and that challenges within the different areas need to be considered in each one of these steps. Subordinated to the six main areas there are more specific challenges, and it is likely that some of these challenges are more closely related to a particular step of growing the business model and require immediate action from the company to sustain and grow the business, while other challenges are more of a constant nature.

In our study, we aim to explore what specific challenges exist within the six identified areas, as well as whether there are additional areas of challenges that should be considered. We will also investigate what types of challenges are more prominent in the different steps of growing the business model, and how these can be handled.

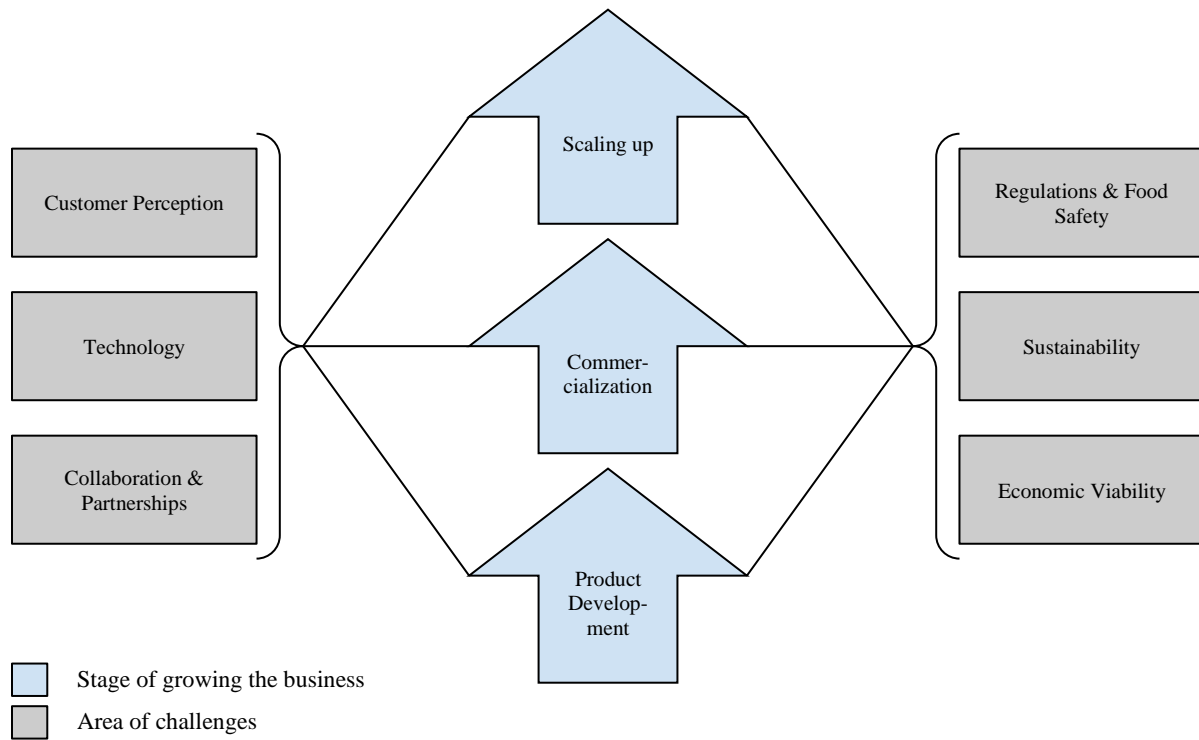


Figure 3. Preliminary framework illustrating areas of challenges associated with three stages of growing a business for upcycled food products (created by authors based on literature review)

3 Methodology

This chapter describes the method applied to address the study's research question and fulfill the purpose of this thesis. The chapter begins by describing the adopted research design, discussing some advantages and disadvantages with this approach. Following that, the method for data collection is discussed, as well as the choice of case companies. Thereafter, we describe how the data has been analyzed and processed to answer the study's research question. Last, the study's validity and reliability is discussed, as well as ethical considerations.

3.1 Research Approach and Design

When settling on a research design it is important to consider that the design of the study should be developed in such a way that it assists the researcher in answering the research question and the purpose of the study (Cresswell & Cresswell, 2023). Therefore, a good starting point for this section is to begin with restating our research question: What are the main challenges associated with developing and scaling up a business for upcycled food products, and how can firms handle these?

Solely based on the research question, one could argue that both a quantitative and a qualitative method is suitable to provide an answer to the research question. Although, due to the limited number of studies conducted on business models within the upcycling food industry, and the inherent complexity of the subject, we deem a qualitative method the most preferable approach. Cresswell and Cresswell (2023) argue similarly and recommend applying a qualitative method when the nature of the study is more explorative and intended to increase understanding. Another important implication of the qualitative method is that focus will be on words and the personal accounts of our respondents rather than numbers (Bell et al. 2022). Pursuing a qualitative method limits the number of respondents compared to a quantitative study which may create concerns for the generalizability of the study (Cresswell & Cresswell, 2023). However, we argue that providing a more in-depth account of the subject is more suitable at this stage and will open for future studies to apply a quantitative approach to test the statistical generalizability.

The relationship between theory and research is an essential part of the research design and something that needs to be addressed (Bell et al. 2022). The two dominant logics are called deductive and inductive reasoning. Deductive reasoning expects the researcher to begin with constructing a hypothesis based on the chosen theoretical approach, which then the empirical data either confirms or contradicts (Bell et al. 2022). Inductive reasoning, on the other hand, begins with a set of empirical observations, where the researcher theorizes and draws conclusions based on patterns identified in the empirical material (Sekaran & Bougie, 2016). Due to the explorative nature of our study, we deem the deductive approach unsuitable since it would restrict our possibility to interpret and explain unexpected or novel findings. Nor do we consider an inductive approach appropriate for our study, since we believe that previous literature about upcycling and business models can provide a valuable foundation for our study. Instead, we chose abductive reasoning, which Bell et al. (2022) describe a third path to overcome the limitations associated with a deductive or an inductive approach. An abductive approach grants us the benefits of having a theoretical framework, while at the same time being open to new findings beyond previous knowledge. Bryman et al. (2022) emphasize that flexibility and adaptability is particularly important for business researchers due to the inherent messiness and complexity of the research area.

After establishing that a qualitative approach was the most suitable for our study, the next decision concerned the specific research method (Cresswell & Cresswell, 2023). We deemed an exploratory multiple case study method appropriate for our study. For a case study to be regarded as a preferable method, Yin (2009) argues that it should fulfill the following three conditions. First, the research question should focus on exploration and include either how, why or what, if used in an exploratory sense. Second, the phenomena can be studied without the necessity of manipulating the behavioral environment as often is done in experimental settings. Third, a case study approach is preferable when the research question addresses a contemporary event or phenomenon (Yin, 2009). We consider our study to fulfill all three criteria, which makes a case study an appropriate method.

Despite many similarities with a single case study, Yin (2009) emphasizes that the choice to conduct a multiple case study should not be taken lightly since it can be time consuming and

requires extensive resources, which may hinder the ability to investigate each case thoroughly. But provided one has the resources, Yin (2009) argues that a multiple case study is preferable to a single case study since studying several cases can contribute to the overall robustness of the study and enable the researcher to capture more aspects than would have been possible from a single case. In the food industry, many of the companies that have a clear focus on upcycling are still relatively small with few employees. This means that individual employees have knowledge about large or all parts of the company, and that it is possible to gain insight into the company's operations rather quickly, which opens the possibility of conducting a multiple case study.

A common critique of the case study methodology is the level of generalizability of a few cases. In a case study, the sample is not seen to represent a larger population. That is because case studies, unlike quantitative studies and controlled experiments, employ a non-random sampling and are highly impacted by contextual factors (Halkias et al. 2022). Although the findings from case studies are not statistically generalizable as in a quantitative study (Yin 2009), they are still valuable to pursue and can contribute with insights that can be applied on a general level (Flyvbjerg, 2006). Especially when combined with other studies and theoretical frameworks, case studies play an important role in the overall research field (Bell et al. 2022). In addition to the multiple case study, we conducted interviews with experts within the field of food upcycling. Partly to substantiate the results from the case companies, but also to highlight areas that were not addressed in the case studies. Doeringer (2020) describes that expert interviews are widely used in qualitative research to explore or gain knowledge about a particular field of action.

3.2. Choice of Case Companies

In the previous section we motivated our choice of conducting a multiple case study, and in this section, we aim to discuss our choice of case companies. The case companies that have been studied are The Other Side of Coffee, Renewal Mill and imPASTA. These case companies are suitable for this study for several reasons. First, they are all food upcycling companies with a product on the market. This means that all the companies have products that have made it past the initial product development phase and have been commercialized, which allows them to comment on challenges in relation to these steps and how they have dealt with them. Second, the companies were founded 4-8 years ago, which means that they have existed for a relatively long time on a

market that has gained traction mostly in recent years. Although the companies are small, with only 4-6 employees, they have all established themselves on the market and scaled up their business to some degree. This means that they have insight into challenges related to scaling up the business, where they have overcome some challenges while others remain.

Third, the companies engage in various forms of upcycling and offer different types of products, which provides insight into various parts of the upcycling industry. The Other Side of Coffee works with coffee fruit, which is a previously underutilized ingredient, and makes it into a beverage. imPASTA works with spaghetti squash that does not meet the esthetical criteria of retailers and makes it into a ready-to-eat product. Renewal Mill utilizes okara and oat pulp originating from the plant-based milk industry which they use to create flour and baking mixes.

In case studies, contextual conditions are part of the investigation, and the non-random sampling allows the researcher to select cases of particular interest (Halkias et al. 2022). Yin (2009) argues that the cases should be carefully selected to either predict similar results, or to predict dissimilar results but for predictable reasons. The case companies selected in this study share some similarities in terms of size and geographical location but offer different types of products and side streams. By examining the companies' business models, we create an understanding of similarities and differences between the companies. This information is thus valuable to create an understanding of what any differences in results between the companies are due to.

3.3. Data Collection

In our study we have collected both primary and secondary data. The secondary data primarily originates from academic journals and books, but also includes gray literature from the case companies' websites and social media, as well as articles about the companies. When dealing with gray literature it is essential to recognize that its reliability and quality may vary; however, it can serve as a useful complement to the primary data.

The primary data, which accounts for the majority of data, was collected through 5 interviews with representatives from the case companies and 3 interviews with industry experts (see Table 1 and 2). Interviews are the most common method for gathering data within qualitative research due to

the ability to dive deeper into the respondents' experiences and ask follow up questions (Cresswell & Cresswell 2023). The interviews were conducted through a semi-structured method ensuring that all relevant parts of our interview guide were covered whilst opening for the possibility to pursue unexpected responses and interesting topics that appeared during the interviews (Bell et al. 2022).

The industry experts were carefully chosen based on their knowledge within the upcycled food market. To ensure a diversity of perspectives industry experts with different skills and backgrounds were chosen. Ensuring that the interviewees have the appropriate competencies is essential for the reliability and validity for qualitative studies since they often heavily rely on the accounts given by the respondents (Bell et al. 2022). The sampling strategy for selecting interviewees among our case companies followed a similar reasoning, where the most salient factor was the respondents' insights into the company's business model and strategic development. Considering the size of the case companies it was granted adequate to conduct 1-2 interviews per firm since a single employee could be expected to have insights into all parts of the organization.

Before the interview sessions, we created a couple of interview guides containing a few main themes intended to cover the necessary topics in relation to our research question. The four themes for the interviews with company representatives were: “General questions”, “Challenges and strategies associated with developing and scaling up the business”, “Challenges related to the company’s business model” and “Reflections on the food upcycling industry”. The purpose of the first theme was to gain a general understanding of the company and the interviewee’s role within the firm. The second theme focused on challenges the firm had encountered in relation to three stages of growing the business: product development, commercialization, and scaling up, and how the firm has worked to address these challenges. The third theme revolved around the company’s business model, to create a more thorough understanding of how the challenges encountered related to various parts of the company. The last section included some general questions regarding the upcycling industry.

The interview guide with the industry experts followed a slightly different structure since the purpose of these interviews was not to study a specific company, but to get a general understanding

of the food upcycling industry. The interview guide for the industry experts was structured around the three themes: “General questions”, “Challenges”, and “Strategies”. The first theme included questions about the interviewees’ profession, and their knowledge and experience within upcycling. The second theme revolved around challenges connected to developing and scaling up an upcycling business. The third section discussed strategies for growing an upcycling business, as well as key aspects for upcycled foods to be able to compete with conventional foods.

A contingency of semi-structured interviews is that it allows the interviewer to alter the course of the interview depending on the participants' responses (Bell et al. 2022). Therefore, emphasis was placed on formulating open ended questions within each theme that easily could be adapted depending on the responses from the interviewees (Bell et al. 2022). Furthermore, follow up questions were frequently asked during the interviews whenever a response was unclear or particularly interesting for our research question.

All the interviews were conducted online via “Google meet”. Although meeting in person is often preferable, video interviewing holds the benefits of being more convenient and saving time (Bell et al. 2022). Furthermore, the geographical distance made online interviews the most realistic approach which also allowed us to consider a broader range of case companies and industry experts. Bell et al. (2022) highlight that a few limitations with online interviews need to be considered such as technical issues, interruptions and ethical concerns. These were addressed through preparation on our part regarding choice of software, location and ensuring the interviewee how we would use the recording. All the interviews were after consent from the participants recorded through applications on our phones and transcribed using a tool called Good Tape. We were both present in all the interviews which we deemed important for accurately understanding and interpreting the respondents' answers. This also gave both researchers the chance to ask follow-up questions during the interviews.

All interviewees were offered the option of being anonymized in the thesis. None of the interviewees from the case companies desired anonymity, they have therefore not been anonymized in this thesis. Nevertheless, we have chosen to refer to the company representatives according to their role within the company instead of their names. Among the industry experts

there were wishes of being anonymous. We have therefore anonymized all industry experts and described their professions in a non-revealing way in Table 2.

Table 1. List of company interviewees

Company	Role	Interview date	Interview setting	Interview duration
The Other Side of Coffee	CEO	18th of April 2024	Online video call	48 minutes
Renewal Mill	President	24th of April 2024	Online video call	36 minutes
The Other Side of Coffee	Co-Founder & Marketing Officer	25th of April 2024	Online video call	50 minutes
imPASTA	Co-Founder & CEO	26th of April 2024	Online video call	45 minutes
imPASTA	CGO (Chief Growth Officer)	2nd of May 2024	Online video call	38 minutes

Table 2. List of industry expert interviewees

Industry Expert	Profession	Interview date	Interview setting	Interview duration
1	Research Support Manager at a NGO working towards more sustainable food systems	26th of April 2024	Online video call	32 minutes
2	R&D Professional at a	3rd of May	Online video call	32 minutes

	food upcycling tech company	2024		
3	Researcher, active within the field of upcycling for more than five years	7th of May 2024	Online video call	34 minutes

3.4. Data Analysis

The data analysis procedure for qualitative research is an on-going process that commences with the start of the data collection and continues throughout the write-up of the findings (Cresswell & Cresswell, 2023). Compared to quantitative research, the qualitative method lacks a clear set of rules for data analysis; thus, the responsibility falls on the researcher to apply an appropriate data analysis procedure based on the nature of their empirical data (Yin, 2009). The main steps of our data analysis process will be derived from the thematic analysis process outlined by Bell et al. (2022). Following a thematic analysis enables the researchers to use previous literature as a baseline for the coding process whilst also leaving room for new findings to be discovered (Bell et al. 2022).

As the data analysis procedure takes place continuously, we purposefully discussed and wrote down some of the main themes and interesting perspectives that appeared after each interview. This enabled us to gain an initial overview of the interviews and served as a first step in the thematic analysis process described by Bell et al. (2022). Furthermore, the audio recordings from the interviews were transcribed using the online software Good Tape which provided us with the main set of the empirical data. To ensure the quality of the transcriptions all the recordings were listened to and compared to the transcript. Due to the vast quantities of data the next step is concerned with decreasing the amount of data through coding and categorization (Bell et al. 2022). Saunders et al. (2006) highlights that the initial codes can be based on the theoretical framework if applicable. In our case, this rendered us with six distinct categories. In addition to the predefined codes other interesting aspects were highlighted. To ensure consistent coding, we followed the recommendations of Cresswell and Cresswell (2023) and created a common understanding of the

codes and when they should be applied. In the initial coding process, we read through the transcripts as well as listened to the audio recordings to capture the different nuances which become clearer in either written text or speech.

The initial coding was followed by theme identification where the researcher should aim to identify the most prevalent themes in the empirical data which are appropriately connected to the research question (Bell et al. 2022). Since the empirical findings appeared consistent with our predefined categories, we identified the six categories as our main themes. The subsequent step entailed further review of the findings within each theme and how they connect to each other, which is in line with Bell et al. (2022). Furthermore, the findings within each theme were structured chronologically within the three stages: product development, commercialization and scaling up. Using a chronological approach in the representation of the results is a common and effective way to convey the results to the reader (Cresswell & Cresswell, 2023).

3.5. Validity and Reliability

An essential part of all research is to ensure and critically judge a study based on its reliability and validity (Yin, 2009; Cresswell & Cresswell, 2023). The concepts reliability and validity are commonly used within quantitative research and there are divided opinions about the applicability of these terms to qualitative studies (Bell et al. 2022). Based on these discussions various alterations of the reliability and validity measures have been adopted to more accurately evaluate the quality of qualitative research (Yin, 2009; Bell et al. 2022; Cresswell & Cresswell, 2023). In this study, we will employ the four criteria outlined by Yin (2009) as appropriate measures for assessing case studies: construct validity, internal validity, external validity, and reliability. Internal validity is only applicable when aiming to prove causal links such as in explanatory research (Yin, 2009), and since our study entails an exploratory approach, this measure has been excluded.

Construct validity refers to the appropriateness of the key concepts and definitions used within a study (Yin, 2009). The key concepts and terms need to be accurately explained to provide the reader with the possibility to assess the relevance of the measures in regard to the objective of the study (Yin, 2009). To strengthen the construct validity of the research we have collected data from

multiple sources, including interviews with both case company representatives and industry experts, as well as from publicly available documents. This method is generally referred to as data triangulation and is commonly used in qualitative research (Yin, 2009).

The valuation criterion concerning the generalizability of a study is called external validity, which is arguably the most criticized aspect of case studies since they focus on one or a small set of cases (Yin, 2009). Yin (2009) emphasizes that the findings from case studies should and cannot be interpreted in the same way as quantitative research, but instead contribute to theory development. These theories can then be applied to new circumstances to validate the generalizability of the study (Yin, 2009). Moreover, by conducting a multiple case study we are able to gain several perspectives. Another way qualitative studies can increase the external validity is through giving detailed descriptions of the cases and findings (Bell et al. 2022; Cresswell & Cresswell, 2023), which we have actively strived to provide throughout the paper. Additionally, we have been open in presenting contradicting information and acknowledge that our biases likely have an impact on how we review the data (Cresswell & Cresswell, 2023).

The final criterion Yin (2009) mentions is reliability which concerns the level of replicability of a study. For a case study to be replicable it is important that the researchers provide the reader with detailed descriptions of the methodological choices (Yin, 2009). Apart from the documentation provided in this chapter, the interview guide can be found in Appendix A and B. Moreover, we established and cross-checked our coding system continuously during the data analysis procedure in line with Cresswell and Cresswell's (2023) recommendations. However, it should be noted that Bell et al. (2022) highlights that replication of qualitative research is specifically difficult due to the researchers' biases and interpretation of the findings.

3.6. Ethical Considerations

In the study we have acted in accordance with the four ethical principles that Bell et al. (2022) list as essential in business research. First the researchers should make sure that no participants are harmed in any way either physically, psychologically or in their career (Bell et al. 2022). The main plausible means of harm within the bounds of this study are connected to career prospects and future employment. To minimize these risks, we ensured that the firms and individuals

participating were fully aware of the purpose of the study, that their partaking was voluntary, and that they at any point could opt-out or decline to answer any questions. Furthermore, all interviewees were offered the opportunity to be anonymous in the thesis. The above-mentioned measures were also taken to address the second and third ethical consideration: Informed consent and protection of privacy (Bell et al. 2022). Additionally, by transparently giving accounts for our methodological choices and truthfully portraying our findings in the result section we actively worked towards avoiding deception, which is regarded as the fourth ethical consideration.

4 Empirical Results

This chapter elaborates on the empirical results derived from eight semi-structured interviews, as well as publicly available documents related to the case companies. The chapter begins with a description of the case companies. Then, challenges and strategies associated with developing and scaling up food upcycling business are described within the three stages product development, commercialization, and scaling up. The discussion within each stage is structured around the six categories outlined in the preliminary framework. Making a distinction between the three stages is considered appropriate since the data shows that challenges and strategies linked to a certain area, such as collaborations and partnerships, differ depending on where the company is in its growth. At the end of the chapter, we present our empirical framework.

4.1 Case Descriptions

Our study involves the three case companies The Other Side of Coffee, imPASTA, and Renewal Mill. All the case companies work with upcycling and are based in the USA. In the following section we aim to give an overview of the companies and address some aspects of their business models. We believe this information is relevant to provide an understanding of the various challenges the companies have faced when developing and growing their business, as well as how different challenges have influenced how the company has chosen to develop its business.

The Other Side of Coffee

The Other Side of Coffee was founded in 2018 and the company currently has six employees, according to the CEO. The company sells coffee fruit juice made from upcycled coffee fruit, which is an often discarded by-product when producing coffee (The Other Side of Coffee, 2024b). The coffee fruit juice they sell comes in three different flavors and is non-carbonated, low-calorie and contains no artificial ingredients. Because of the coffee fruit, the juice is rich in antioxidants and contains 30 ml of caffeine per can (The Other Side of Coffee, 2024a). The CEO described that their main customer group are health-conscious people, and that they typically range between 29 and 40 years old.

The CEO explained that the company imports coffee juice concentrate from Colombia and

produces their beverage in the U.S. Both the CEO and the Co-founder of the company describe coffee juice concentrate as a key resource for the company and therefore the collaboration with the supplier of the concentrate is of particular importance. The company is located on the West Coast of the U.S., selling their beverages in stores in Arizona and California (The Other Side of Coffee, 2024c). The CEO described that the company's main revenue stream is selling to distributors, who then resell the product to retailers. Another revenue stream the CEO mentioned was online sales. The company for example sells its products on its webpage and on Amazon (The Other Side of Coffee, 2024a; Amazon, 2024b).

imPASTA

According to the Co-founder, imPASTA has six full time employees and is divided into two separate parts. One part focuses on CPG (Consumer Packaged Goods) and sells a ready-to-eat spaghetti squash product (imPASTA Foods, 2022a), and the other part works with sustainable sourcing, connecting farmers with buyers of agricultural products (imPASTA Inc, 2024). We will in this thesis focus on the CPG-side of the company, founded in 2020.

The ready-to-eat spaghetti squash product is based on squash that due to cosmetic scarring does not meet the requirements for ordinary retail sale, and thus otherwise gets wasted (imPASTA Foods, 2022b). The Co-founder of the company explained that the product is sold to meal kit and foodservice providers in North America. The company works closely with the farmers, and one of the Co-founders of the company is a fourth-generation family farmer (imPASTA Foods, 2022c). According to the Co-founder, imPASTA outsources marketing and packaging of the product to other companies.

Renewal Mill

Renewal Mill was founded in 2016 and is based in California, USA (Renewal Mill, 2024c). The company creates high fiber, gluten free flours and baking mixes from by-products primarily originating from plant-based milk production (Renewal Mill, 2024b). They describe okara, which is the soy pulp leftover when producing soy milk and tofu, as their flagship ingredient (Renewal Mill, 2024c), but they also use oat pulp and other upcycled ingredients such as pineapple fiber, white corn flour, and green banana flour (Renewal Mill, 2024c).

According to the President of the Renewal Mill, the company has four full time employees and works with two different revenue streams, one being ingredient sales to other businesses and the other CPG. The company launched nationally at Whole Foods in 2022 and is also available for purchase in other stores in the U.S., as well as online (Renewal Mill, 2024a; Amazon, 2024a). According to the President, the company has three main customer groups on the consumer side. The first customer group are those who like to bake and experiment with their flours. The second encompasses those who live with and care for someone else with an allergy. The last group are those baking for an event or a dinner party, where one of the guests does not eat gluten.

4.2 Product Development

Customer Perception

Already at the product development stage, companies need to consider customers' needs and preferences. Several of the company representatives mentioned that the customers value taste highly and mentioned it as an important aspect to gain public acceptability of the products. Similarly, industry expert 3 echoed that "If you do not get the sensory aspects, specifically taste, right, you cannot go to the next stage" "Or if you release it in the market, no one will be interested in it". Additionally, industry expert 3 described taste and getting the sensory aspects right as one of the biggest challenges working with upcycled products. For example, the industry expert mentioned that brewers spent grain, a residual from the beer industry, can be used in bread, but that it gives the bread a bitter taste. Upcycling companies may thus need to go through several trials to get the taste right, and perhaps the proportion of the upcycled raw material in the product needs to be reduced, the industry expert explained. The industry expert added that if the upcycled product is a replica of a common food, customers may expect a similar taste or sensory features, which can make it difficult for companies to live up to their expectations. The Co-founder of The Other Side of Coffee mentioned that they conducted several consumer tests and used focus groups during the product development process to assess the taste and public acceptability of their product.

Technology

Several of the respondents mentioned technical challenges are particularly prominent when developing the product. The Co-founder of The Other Side of Coffee described that the market for

the coffee juice was almost non-existent and that the company had to spend a lot of time on R&D. Similarly, the President of the Renewal Mill mentioned that initial challenges were one, creating the product, and two, figuring out how the product could be used in a good way. Working with a completely new product, the companies also faced challenges with accessing the right equipment. The Co-founder of imPASTA described that the processing equipment the company needed did not exist at the time and that developing new equipment would have been very expensive. To combat this challenge, imPASTA started working together with contract packers, repurposing their existing equipment to the needs of the company. The President of Renewal Mill also described that manufacturing often requires large upfront investments and said that it requires great belief in the product, especially when working with an unproven and uncommercialized ingredient.

Partnerships and Collaborations

The case companies described partnerships and collaborations as important in all stages of growing the business. During the development stage, it is described as particularly important to get access to people with knowledge in research and development. The Co-founder of imPASTA mentioned that the company collaborated with a food innovation college to develop their product. Likewise, the president of Renewal Mill explained that the founder of the company worked together with the USDA to develop the process of turning soy pulp into flour on an industrial scale, which could then be applied to other types of pulp as well.

Finding suppliers of the raw material and processing companies with the right competences are also described as important. A key partnership for the Other Side of Coffee when developing their product was finding a supplier of coffee juice concentrate. However, the CEO of the company mentioned that there were not a lot of suppliers who could produce something from coffee fruit. Similarly, the Co-founder of imPASTA mentioned some difficulties in finding a contract packager with the right equipment for their product, as mentioned in the previous section. Both companies managed to work around these challenges and The Other Side of Coffee eventually found a supplier that had already spent several years in R&D and was able to effectively make coffee fruit concentrate. However, the CEO of The Other Side of Coffee described that the company is highly dependent on the supplier since there are not many other companies selling coffee juice concentrate.

Regulations and Food Safety

The Co-founder of imPASTA mentioned that there are a lot of regulations and things to be aware of to ensure food safety, which makes the industry challenging. When developing an upcycled product, industry expert 3 mentioned that companies have to investigate whether the side stream they want to use for upcycling is safe for consumption and adhere to food safety standards. The industry expert explained that if the raw material was not produced for human consumption in the first place, the side stream cannot be used as an ingredient for upcycled food either. The industry expert added that companies also need to consider food safety risks, such as if the product gets moldy quickly at some stage during the processing. In line with this, the Co-founder of imPASTA mentioned that they must be quick to manufacture the product, since the squash has limited time from when it is picked to when it decays and is no longer good.

For The Other Side of Coffee, the strict food safety regulations caused some initial problems. The CEO described that since coffee fruit is a relatively unknown ingredient, there was no code for importing, which complicated the transport from Colombia to the U.S. The CEO described that the company initially produced, manufactured and bottled the beverage all in Colombia and then transported it to the U.S. However, recognizing the need for a smoother logistical process, the company transitioned to only importing the coffee juice concentrate, and manufacturing and packaging the beverage all in California. This decision made importing easier since they had an established and trusted supplier who could then validate the shipment. Subsequently, the WHO recognized coffee fruit as an item, which also made importing easier, the CEO explained.

Sustainability

In all the case companies, it was the knowledge that the raw material in question was wasted that gave the founders the idea of upcycling it into something of higher value. Although upcycling has the potential to contribute to a more sustainable food system by reducing food waste, the industry experts mentioned that there are some aspects to be aware of. Industry expert 3 emphasized that consideration needs to be given to the food waste hierarchy to assess if upcycling is the most suitable option. Similarly, industry expert 2 stated that “we should not be upcycling for the sake of upcycling” but it has to make sense from a business, nutrition, and sustainability perspective.

All industry experts mentioned that one way of assessing the environmental impact of the product is through conducting a life cycle analysis. Industry expert 1 emphasized that this type of assessment is not something that can be done once to say whether a product or a process is sustainable or not, but something that needs to be continuously revised. Furthermore, the industry expert highlighted that different types of trade-offs make it difficult to evaluate if a product is sustainable or not, e.g. maybe greenhouse gas emissions can be reduced by upcycling a particular product, but a lot of water is required. This is thus a challenge that upcycling companies need to be aware of if they aim to develop a sustainable product.

Another sustainability related challenge that industry expert 1 talked about is where to locate. The expert explained that for side streams derived from food processing it makes most sense to build a factory nearby, but that for agricultural products the logistics of harvesting and collecting the crop can become more challenging. Furthermore, aspects such as access to renewable energy and proximity to market are important to consider regardless of the type of upcycling processes. The CEO of The Other Side of Coffee mentioned that they started out manufacturing and packaging the beverage in Colombia close to the supply of coffee fruit, but quickly realized that it was unsustainable to ship the weight of the bottles and large volumes of liquid. Therefore, they decided to only import the coffee juice concentrate, and move the manufacturing of their product closer to their main market in the US.

A social sustainability aspect is whether the farmers growing the produce used for upcycling should be compensated or not. Industry expert 1 explained that by selling the side stream upcycling has the possibility to provide farmers with an additional income. However, it is unclear what the pricing should look like and often upcycling companies arrive at their own conclusion that the side stream is free, which the industry expert argued is not something to be assumed. The Co-founder of The Other Side of Coffee also pointed to a lack of guidelines regarding pricing of side streams. The Co-founder explained that on one side the company feels like they should compensate the farmers for the valuable ingredient, but on the other hand they are doing the farmers a favor by taking the coffee fruit, since they otherwise must pay a tax to get rid of it. The CEO of The Other

Side of Coffee mentioned that they took an active decision to compensate the farmers, but that they were the first coffee fruit company to do so.

Economic Viability

Since all the case companies developed a new product, it required different forms of investment linked to R&D. For these investments, firms need to acquire funding, especially in the early stages before they have developed a steady revenue stream. The case companies did not discuss this aspect in detail although the Co-founder of imPASTA mentioned that the company received a government grant to develop their product. Furthermore, Renewal Mill raised \$1.7 million within the first few years to develop and commercialize their products (Shoup, 2020). However, the Co-founder of The Other Side of Coffee, described that they had no external investors but relied only on personal capital when developing their product. Since they did not have a lot of money the three Co-founders had to do as much as possible themselves and learn in the process, the Co-founder described. While many of the costs and challenges are similar to most CPG firms, some are more industry or firm specific. For example, the Co-founder of the Other Side of Coffee described that the FDA did not have information about coffee fruit, and the company therefore had to put a lot of time and money into providing studies on what coffee fruit is to import it to the U.S. This thus became an extra expense for the company.

Working with upcycling and underutilized resources involves certain trade-offs. While the side streams are often relatively cheap, or free, they may require costly processing to be made into an edible product. Industry expert 1 highlighted that the type of by-product that is being used, and how established the processing of it is, has a big impact on how challenging it will be to upcycle the raw material and whether it will be economically viable at an early stage or require more effort. Industry expert 1 highlighted that agricultural and food processing waste currently are the most viable sources for upcycling since they are quite homogenous and often produced in large quantities. Household waste from the end consumer on the other hand entails a whole new set of challenges related to logistics, food safety and variability in quality, which makes this type of waste less viable for valorization at this stage.

4.3 Commercialization

Customer Perception

When commercializing the products, one of the main issues that the interviewees discussed was the lack of knowledge among consumers about their novel products and what upcycling is. Both the Co-founder and the CEO of The Other Side of Coffee emphasized that this was and still is one of the main challenges for them, since their product is based on the underutilized coffee fruit which was unknown to most people when they entered the American market in 2020. In addition, the concept of upcycling is new, and the Co-founder stated that most people do not yet know what it means. A similar picture was shared by the other case companies as they also commercialized novel upcycled products to the market. The Co-founder of imPASTA mentioned that although spaghetti squash is not a new ingredient, their way of preparing the product and using cosmetically scarred produce was new and entailed challenges with customer communication. Likewise, the President of Renewal Mill clarified that they were the first to produce okara flour on an industrial scale.

To tackle the challenge with lack of knowledge all three firms have focused on creating awareness and educating customers in different ways. The CEO of The Other Side of Coffee explained that in the beginning they found most success when being able to communicate about their product firsthand to consumers at farmers markets and events. The president of Renewal Mill, on the other hand, emphasized that communicating on the packaging has been really important for them to develop their brand. Industry expert 2 highlighted the importance of effectively conveying a clear and appealing message to consumers to influence their often quick purchasing decisions when in stores. The Co-founder of imPASTA mentioned that when they started out, they were still unaware of the concept of upcycling and therefore did not emphasize the upcycling aspect in their marketing. Instead, they focused on educating their customers about the new product they brought to market and highlighted the convenience aspect and that it is a low carb substitute for regular pasta. Since then, imPASTA has become aware of upcycling, and the company became a member of the Upcycled Food Association in 2021. Both the CGO and the Co-founder mentioned that upcycling is now part of their communication, but not their main focus. Although they want the upcycling and sustainability message to be a larger portion of their communication. Similarly, The CEO of The Other Side of Coffee said this about their communication regarding upcycling to

consumers “We wanted it to be our champion, like this is what we are doing. But the more that we push that, the less we sell”. The Co-founder shared a similar observation, that just saying upcycled is not enough but that “It has to be upcycled attached to something else, to great flavor, to health benefits”. Likewise, the CEO of Renewal Mill emphasized that it is the taste and health aspects that seem to be the most important for their customers currently.

Another challenge that was discussed by several of the interviewees was how to communicate to customers that upcycled products originate from a traditionally wasted by-product. Industry expert 2, the Co-founder of imPASTA and the President of Renewal Mill all mentioned that when they speak about food waste many consumers associate it with what they throw away in the bin at home, and not with the perfectly edible excess food that comes from regular food production. Furthermore, industry expert 1 explained that due to upcycling utilizing commonly wasted products consumers may perceive that the food is of lower quality and should be priced lower than conventional food alternatives. For customers to associate upcycling with something positive, representatives from all three case companies emphasized that they are very intentional in the way they communicate about the concept. Instead of using the word food waste, the Co-founder of imPASTA advocated for the use of underutilized food asset instead, and industry expert 2 said that some companies in the industry have started talking about rescuing food and rescuing nutrition. The President of Renewal Mill highlighted that it is important to explain to customers that the reason why customers have not encountered similar products earlier is due to the lack of market demand and not because of the quality of the by-product.

Technology

Based on the data collected, the main challenges regarding technology appeared to be in the product development stage as well as when scaling up the business. Thus, we will not address any specific technological challenges in the commercialization stage.

Partnerships and Collaborations

Different types of partnerships and collaborations became important for the companies when commercializing their products. Not least, partnerships became important for creating channels where the companies could reach out to customers. The CEO and the Co-founder of the Other Side

of Coffee described that the company early on started collaborating and selling their product through coffee shops and local mom-and-pop shops. The Co-founder emphasized that “Especially those coffee shops and those owners that are really into coffee and the whole culture around coffee, they were super interested in trying the product”. However, the CEO of the company mentioned that it is more difficult to get into the big stores since they all require a distributor. The CEO described it as a chicken or the egg situation where the stores do not take the company’s product unless they have a distributor, and many distributors do not take the company’s product unless they already have the retail stores. Furthermore, many retail stores want the company to be able to present data on how well the product performs in stores for them to include it in their assortment, which can be difficult to provide when the product is new on the market. Similarly, the Co-founder of imPASTA said that “it is really difficult for smaller brands to get into retailers.” and the CGO of the company mentioned that large companies to a large extent value cost savings and reliable supply chains. However, the CEO of The Other Side of Coffee was of the opinion that the company, because of their product and the mission they are working on with upcycling, get more opportunities than other companies. The CEO described that retailers in general are very appreciative of their product when they understand what it is and that they eventually found a distributor that focused on bringing in new, innovative products who decided to take in their products. “It is finding those like-minded companies to work with. They are very open to partnering.”, the CEO said.

During the interviews it appeared that the companies have carefully chosen through which channels and partners they are selling their products, and that some of the companies have tested different types of channels. The President of Renewal Mill described that the company initially focused on online sales and ingredient sales to other businesses, but that they started to focus more on CPG around 2020. The President mentioned that the company went national and got into Whole Foods in 2022 and said that being within the natural channel and being associated with Whole Foods has been really helpful for the company in terms of messaging to customers. The Co-founder of imPASTA described that the company has done tests with retail but that they currently are not selling in retail at all. Instead, they are focusing on the food service and meal kit space. “We want to get it on consumers' plates, because they do not know about spaghetti squash.”, the Co-founder described. Similarly, the CGO of the company described the meal kit segment as beneficial since

the company can then get their product out to customers who otherwise would not have bought it, which reduces some of the company's marketing costs. However, the Co-founder mentioned that they plan on going back into retail in the near future.

Regulations and Food Safety

The participants stressed the significance of guaranteeing food safety and adhering to food safety regulations at all phases of business expansion. However, they did not specifically address any challenges related to commercialization.

Sustainability

Apart from the previously mentioned challenges in the product development stage the interviewees did not discuss any new sustainability issues specifically related to commercialization. However, the aspects raised in the product development stage are still necessary to consider in this stage.

Economic Viability

A challenge all three case companies mentioned was that commercializing a product is expensive and requires large upfront investments. The Co-founder of The Other Side of Coffee mentioned that in addition to the already discussed struggles with convincing distributors and retailers to take their product in, companies must pay for a place in their assortment and shelves. According to the Co-founder this is particularly challenging for start-ups with small economic resources compared to large established firms that have relationships and resources to launch their products everywhere from the start. Furthermore, the CEO of The Other Side of Coffee explained that for production to be economically viable they are required to produce in large bulks which incurs large upfront payments and storage costs. The President of Renewal Mill also mentioned that the distributors and retailers have high demands on supplier stocks and a reliable supply chain which entail large upfront investments. Another area which requires heavy investment at an early stage according to industry expert 2 is brand building and communication.

4.4 Scaling up

Customer Perception

A challenge for scaling up is reaching a larger group of customers. Industry expert 1 mentioned that while the upcycling message might resonate with some environmentally conscious consumers, the large majority are mainly interested in taste and affordability. Upcycled food products are often more expensive than conventional food products, which the President of Renewal Mill described is due to the specialized equipment and manufacturing required for upcycled products. Consequently, none of the case companies are currently pursuing a low-price strategy, but instead they focus on highlighting other values, such as the taste, convenience, and the health aspects of their products. The President of Renewal Mill described that by focusing on the product's taste and health benefits, customers are prepared to pay a premium for their product. However, all the industry experts highlighted price as a critical aspect in order for upcycled foods to be able to compete with conventional food products. Economies of scale is described by both industry experts and company representatives as an important part in reducing the price of upcycled products. Nonetheless, industry expert 2 highlighted the difficulty of reducing prices, since scale requires more people to buy the product, and at the same time a low price is an important prerequisite for more people to buy the product.

Technology

Some of the respondents mentioned that increased standardization and more adapted equipment will be required to scale up the business further. The Co-founder of imPASTA mentioned that the company is currently using old equipment that has been repurposed for their production process, but that it is not ideal. While it was a cheaper solution that got the company past the initial step, the Co-founder mentioned that they aim to develop custom equipment at a later stage when the company is larger.

Partnerships and Collaborations

One challenge for upcycling companies raised by the President of Renewal Mill is that they can be dependent on another supply chain and the demand for a whole different subcategory of foods. For Renewal Mill their okara and oat pulp supply is dependent on how the market for plant-based milks develops. In the case of Renewal Mill they believe that these supply streams will be relatively stable in the foreseeable future, but the President mentioned that this may become a bigger issue for companies working with more niche side streams. Industry expert 3 also

highlighted that upcycling firms need to consider if their side stream will be continuously available over time and to what extent.

The President of Renewal Mill emphasized that it is important to acknowledge how big the firm can grow with current supply in the market and continuously assess the market which the by-product stems from. The CEO of The Other Side of Coffee mentioned that they do not have any concerns with outgrowing their current supplier due to coffee fruit being such an underutilized ingredient. However, the Co-founder described that they currently are unable to market themselves as organic due to the lack of organic coffee plantations collecting coffee fruit, which negatively impacts their sustainable branding opportunities.

Regulations and Food Safety

While the respondents emphasized the importance of ensuring food safety and compliance with food safety standards at every stage of growing the business, no particular challenges were addressed in regard to scaling up.

Sustainability

When growing and scaling up the business, industry expert 3 mentioned that it is important to assess if the supply is sustainable and continuous on a large scale. Similarly, the President of Renewal Mill emphasized that it is important to assess from an ethical and sustainability standpoint how large the company can grow with current supply constraints. The CEO and the CGO of imPASTA, explained that they have identified several future challenges working with leftover agricultural crops and ensuring a sustainable supply stream. One challenge is connected to growing regions and seasonality. According to the CEO it may require imPASTA to source from different regions which will incur additional costs and environmental impact. However, industry expert 1 mentioned that for some fruits and vegetables that require specific growing conditions it makes more sense from a sustainability perspective to import them from another region than to grow them in suboptimal locations. Sourcing from an international supply chain can incur additional issues regarding logistics and may require further processing if the produce is transported over long distances.

Economic Viability

Industry expert 2 mentioned that a lot of challenges for upcycling companies are the same as for all businesses who try to disrupt a category with a new product. For example, companies need to reach a certain scale of their operations to bring down the cost per unit, industry expert 2 explained. Industry expert 1 also described that processes in general become more efficient and cost effective when they are scaled up, and that transitioning to more upcycled foods will require large companies with large scale processing capacity. Furthermore, industry expert 1 mentioned that upcycling companies should be aware that while many side streams are free today, that will not necessarily be the case if these side streams become more desirable in the future. In line with this, the CEO of the Other Side of Coffee mentioned that they have experienced an increase in raw material prices as the demand of the product has increased.

4.5 Empirical Framework

Based on the empirical findings, we have in Figure 4 compiled which challenges are prominent for upcycling companies within the three stages of growing their business. The overview has been developed based on the preliminary framework but has been extended by describing the main challenge within each of the six themes for each stage. Thus, each main challenge should be read as belonging to one area (vertical), and one stage of growing the business (horizontal).

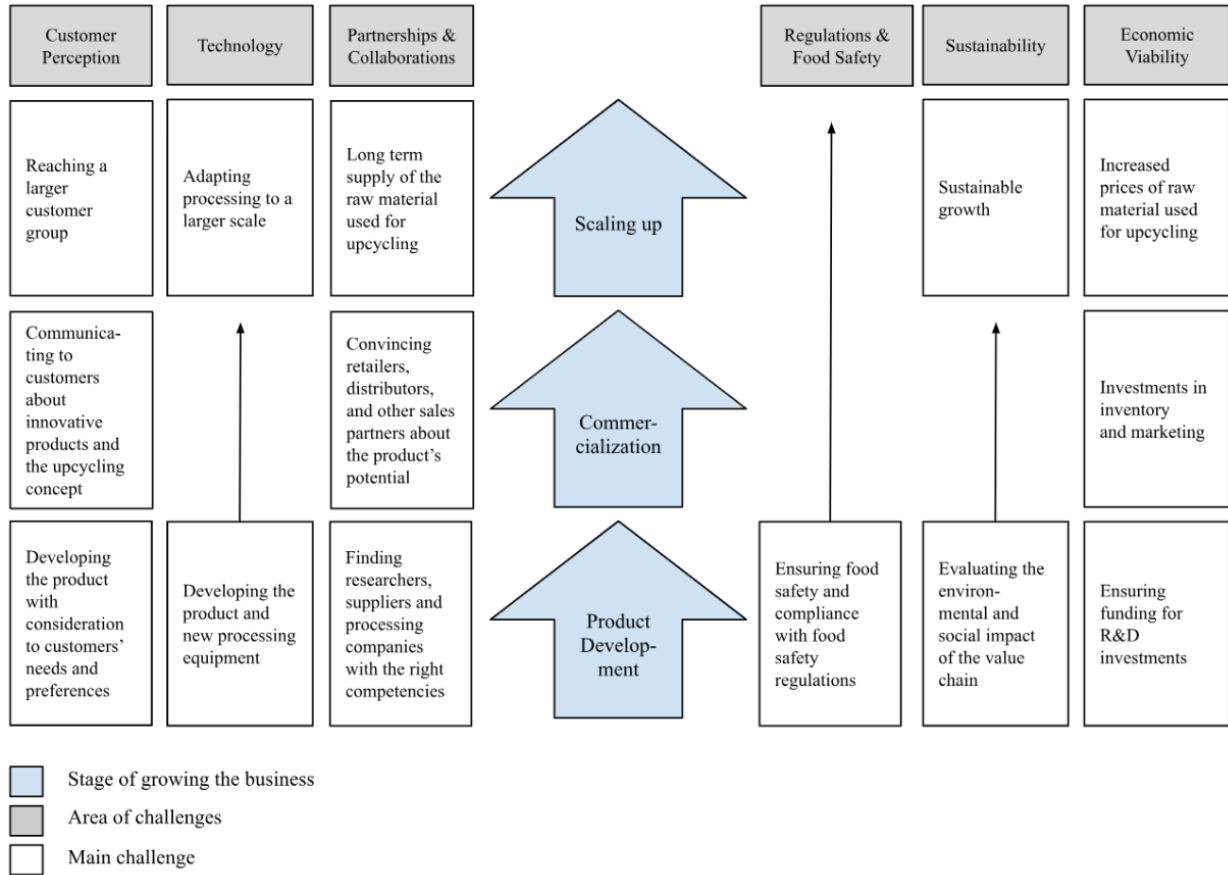


Figure 4. Empirical framework describing challenges associated with the different stages of growing a business for upcycled food products (created by authors)

5 Discussion

The purpose of this chapter is to discuss the empirical results and position the findings in relation to previous research. The chapter is divided into four sections. The first three sections discuss challenges associated with each of the three stages of growing an upcycling business - product development, commercialization, and scaling up -, and how these challenges can be addressed by firms. Unlike the empirical chapter, the challenges are not placed within six specific areas, but instead the areas of challenges are weaved together in a common discussion within each of the three stages. While dividing the challenges into six areas was helpful to understand the problems from different angles, we consider it necessary to depart from these categories to understand the full complexity of the challenges. Many challenges are interconnected and encompass solutions across different areas of the business, which we aim to highlight in this chapter. In the last section of the chapter, we also underline the importance of understanding challenges and strategies in relation to the companies' business models, as they greatly influence each other.

5.1 Product Development

The empirical findings showed that upcycling companies may face several challenges throughout the product development stage. Similarly to what Schuh et al. (2020) described as the first step of product development, our case companies started out with some kind of problem identification which led to an idea. Our results highlight that it is important to have the customer perspective in mind already in the product development stage since customer acceptance is key for the product to be successful, which is also emphasized by Mattsson and Sorensen (2020), and Rakesh and Mahendran (2024). In addition to previous research, our findings underline the importance of getting the taste and the sensory aspects right for the product to gain market acceptance. However, getting these features right appears to be particularly difficult when working with upcycled food products since the side streams used often have been disregarded because of undesirable properties, not least in terms of taste and sensory features. This entails that there often are technical challenges with developing the products to match customers' needs.

Since the concept of upcycling on an industrial scale is a relatively new phenomenon, the techniques for processing the side stream are in many cases still underdeveloped. Our results

showed that this led to long periods of R&D before companies could create a fully functional and marketable product. As described by Salvatore et al. (2024), this implies great costs for upcycling companies looking to develop a novel product. Our findings showcase different ways of dealing with this initial hurdle. For example, Renewal Mill reached out to external investors at an early stage to fund their product development process, while imPASTA collaborated with the academic sector and received a government grant to fund their research. The Other Side of Coffee, on the other hand, showed that it can be viable to build a business without external funding, but that it requires a lot of effort and time from the founders' side.

Our empirical data highlights regulations and food safety as an important area to consider when developing an upcycled product, which is in line with previous literature by Salvatore et al. (2024) and Moshtagian et al. (2021). Apart from ensuring compliance with regulatory requirements and adopting safe processing methods, an interesting finding is related to working with novel ingredients. One case company encountered several problems due to the lack of knowledge about their by-product (coffee fruit) from both national and international organizations such as the FDA and WHO. This led to problems with importing and the firm was required to provide and pay for expensive studies on the product. This example shows how regulatory issues may increase the barrier of entry for firms utilizing new types of ingredients. This challenge is particularly important to consider for companies aiming to either create novel products or utilize novel ingredients. Our results show that collaborations with established actors and official recognition by legislative bodies are important aspects to overcome these challenges.

Another key challenge that became apparent in our results is connected to assessing and finding a sustainable supply of the by-product. Identifying waste in the food value chain is not a big challenge in itself since about 30% of all harvested food is wasted (Rakesh & Mahendran, 2024). However, our findings highlight that many sources of waste are currently not suitable for upcycling. The most clear example being household waste, due to variability in quality, difficult logistics and food safety concerns. On the other hand, our results point toward that agricultural waste and food processing waste are fully viable options, with the caveat that certain types of industrial food waste are less suitable for upcycling due to food safety and legislative issues which also has been emphasized previously by Hagman (2023).

Additionally, the full environmental impact of the production process should be taken into consideration when developing a new product. Since one of the objectives of upcycling is to decrease the environmental impact of the food industry it becomes contradictory if the upcycling process incurs a large environmental strain. Furthermore, companies need to consider the social sustainability of their operations. As emphasized by Donner et al. (2020) and Aschemann-Witzel et al. (2021) upcycling can provide farmers and suppliers with an additional revenue stream. However, our results indicate that there seems to be a lack of industry standards regarding how and to what extent farmers and suppliers should be compensated for the waste product. The Other Side of Coffee mentioned that they were the first coffee fruit company to pay the farmers for the by-product, implying that other actors in the industry receive it for free. This raises the question who is responsible for ensuring that all parties receive a fair share of the pie.

To summarize, the main challenges within the product development stage appear to originate from either using a novel by-product or producing a novel end product. Utilizing and developing a novel product entails technological challenges regarding new processing equipment which in turn requires finding suppliers, competencies and manufacturing possibilities. It also entails a costly R&D process that requires funding. Furthermore, upcycling companies in the development stage need to consider food safety and regulatory issues, assess the overall sustainability impact, and design the product based on customers' needs. These interconnections between the different challenges illustrate that each challenge should not only be addressed independently but needs to be considered from a broader perspective.

5.2 Commercialization

Based on the empirical data, one main challenge for upcycling companies revolves around how to successfully communicate the product offering to customers. Our results indicate that the issues, among other things, stem from a lack of knowledge about the novel product and the upcycling concept. This is in line with the research of Aschemann-Witzel and Peschel (2019), where they describe convincing customers to try a novel product as a main challenge for companies entering the upcycling industry. Our results show that the case companies work with educating customers about their product and the upcycling concept in various ways to get the customers to buy the

product. One central finding was that while customers perceive upcycling as something positive, it is not enough for them to purchase the product. The case companies described that customers are more interested in other aspects such as taste, convenience, or the health benefits of the products. Thus, they highlighted that when communicating about the product offering it has to be upcycling attached to other values.

Previous research by Goodman-Smith et al. (2021) and Zhang et al. (2021) found that educating customers and communicating the benefits of upcycling increase customers' likelihood of purchasing upcycled products, but our results do not unilaterally show that this is the case. One respondent from The Other Side of Coffee described that the more they communicate about upcycling the less they sell. However, the same interviewee described that the customers are very positive about their product and the upcycling concept when they have the possibility to communicate about it in person at events. This suggests that while customers appreciate upcycling, it is important for companies to consider how much they communicate about upcycling versus other values of the product. What values the company's customers care about is likely to depend on the specific customer group. For example, The Other Side of Coffee's main customer group is health-conscious people, which makes it particularly important for the company to communicate these characteristics of the product.

In addition to what extent the companies communicate about upcycling, our results also indicate that it is important for upcycling companies to consider how they talk about the upcycling concept. Studies conducted by Bhatt et al. (2020) and Nyhan et al. (2023) show that customers perceive upcycled products to be of lower quality than conventional food products since they are made using otherwise wasted by-products. However, our results show that how companies communicate about upcycling has a big impact on how customers perceive it. Several respondents described that customers associate the word "food waste" with the trash they throw away in the bin at home, instead of the perfectly edible excess food derived from food production. For this reason, our results indicate that it is essential for upcycling firms to be intentional about how they communicate about upcycling and that they use words with a positive connotation. Respondents described that they use words such as "underutilized food asset" or "rescuing food", instead of "food waste".

In addition to paying attention to how to communicate about the product, it appears from the results that getting accepted by retailers involves certain challenges. A study conducted by Thorsen et al. (2022) described reaching retailers as an important step for the upcycled industry to establish itself and grow. However, the authors describe that reaching store shelves can be difficult for upcycling companies working with innovative and unproven products, since retailers want to be sure that there is a demand for the products before they include it in their assortment. Our results paint a similar picture, and respondents described that there is an initial threshold, partly to enter the larger stores, but also to get accepted by a distributor, which is a prerequisite for entering the stores. In line with previous research by Thorsen et al. (2022) a respondent also raised the issue of retailers requesting data for how well the product has performed, which is difficult to provide when the product is new on the market.

In addition to highlighting the difficulty of getting into stores, our results raise the question of whether a focus on upcycling is an advantage for companies when persuading retailers and distributors to take in their product. Our study provided us with mixed results, where one of the case companies mentioned that they get more chances than other companies because of their unique upcycling product, while the others did not mention similar benefits of being an upcycling company. They instead emphasized that most retailers and distributors prioritize the economic aspects and reliable supply chains. Our results can thus be interpreted as the main priority for upcycling companies should be to meet the financial and logistical requirements of retailers. However, upcycling can provide the companies with a unique selling point, which can be particularly beneficial if the company seeks out partners that have a focus on innovation and sustainability.

But the challenge of launching a new product is not just about convincing retailers and distributors, ultimately it is about gaining market acceptance and getting customers to buy the product, which is emphasized by Schuh et al. (2020). imPASTA conducted tests with different food chains, but eventually chose to focus on selling to meal kit services and restaurants. The company chose this approach to increase awareness of the product before launching it in stores. Renewal Mill also focused on B2B sales initially. From our results it appears that companies need to invest large

sums in marketing at an early stage to reach out to customers and create awareness of the product. To then focus on B2B initially offers the company the advantage of being able to reach a large number of customers and sell in large quantities without having to convince each individual customer to buy the product.

In summary, there seems to be an important link between customer perception and partnerships. That customers demand the company's product is in many cases a prerequisite for collaborations with retailers and distributors. At the same time, retailers and distributors provide important channels for reaching out to customers and play an important role in strengthening the company's brand. This interaction illustrates how companies need to work in parallel with these areas to successfully commercialize their product. Furthermore, companies have to consider to what degree they should communicate the upcycling narrative and be mindful of the words they use to describe the origin of the by-product.

5.3 Scaling up

For the upcycled food industry to grow and compete with conventional foods, our results suggest that the price of upcycled products would have to be reduced. Industry expert 1 described that while the upcycling aspect might be enough for some environmentally conscious customers to purchase the products, most customers are mainly interested in taste and affordability. This is in line with previous research by Goodman-Smith et al. (2021), who found that only 12% of respondents were prepared to pay a premium for upcycled products. As described by Goodman-Smith et al. (2021), upcycled products need to be comparable in price for a majority of customers to want to buy these products, provided the products are of similar size, taste etc. Previous research, as well as our results, thus do not imply that upcycling companies are unable to position themselves as more expensive than comparable options, but that they then are limited to a niche of the market.

While positioning as a premium brand or attracting environmentally conscious customers can offer specific companies great opportunities for growth, our results show that both companies and industry experts believe that price is a critical aspect for the upcycled food market as a whole to grow and compete with conventional foods. Our empirical data suggests several challenges with reducing the price. One of the main obstacles to lowering the price is connected to reaching

economies of scale in terms of production quantity. Furthermore, entering the highly competitive food market with a previously unknown ingredient or product requires a lot of initial marketing costs, which affects the price of the product. Another challenging aspect for the long-term growth of upcycling companies and the upcycling industry in general is that the prices of by-products likely will increase as they grow in demand. A drastic increase in the price of the input resource could potentially affect the economic viability of the upcycled product, which is something that firms operating with by-products need to consider.

Based on our results, we can identify that another area of challenges for scaling up revolves around sourcing the by-product and managing the supply chain. An interesting aspect is that many upcycling firms are dependent on the demand of their suppliers' main product. For example, Renewal Mill's supply of Okara relies on the demand and production of soy milk. This dependency can become problematic and create uncertainties in a few different ways. The most apparent one is if the demand for the original product decreases, which will impact the amount of available by-product. The dependency also entails that the maximum production of an upcycled product cannot outgrow the demand for the main ingredient as it is unlikely and sustainably not viable to continue producing something solely for the sake of the side stream. Therefore, upcycling firms need to be aware of how large they can grow, both based on the demand for their product and the market demand for their input products' other uses. When the company grows, it might have to source its by-product from multiple suppliers. Our results show that this entails two main challenges. One is related to the logistical and technological demands whilst the other challenge is related to the environmental impact of transportation, if the supply chain is located across different regions. In line with Donner et al. (2020), our findings indicate that varying quality of the by-product can pose a significant issue and incur additional costs for upcycling companies. Furthermore, as for any company pursuing a sustainable business model, they need to consider if it is justified from a sustainability perspective to transport the product over long distances.

Moreover, our results point to a lack of norms and regulations within the industry regarding the ownership of the by-products. This could open for situations where new processing equipment for the main product is developed to either alter the nature of the by-product or incorporate the side stream into the main product, which would require the upcycling company to invest in new

processing equipment, alternatively leave it without access to its key ingredient. In line with Donner et al. (2020), our empirical data suggests that upcycling companies should create close relationships with their suppliers to ensure a long-term access to the side stream they use in their products. Establishing long term relationships with suppliers is of course not something that only upcycling companies should consider; however, from a supplier point of view, it is not certain that the side stream will be prioritized equally to the primary product. It should be noted that none of our case companies expressed any problems in regard to being down-prioritized by their suppliers, but we believe that this is something that could be problematic for upcycling companies and should be addressed by future research.

To summarize, for upcycling companies looking to scale up, the majority of challenges are related to increasing production capacity and reaching a larger customer base. As in the previous stages, these challenges are interconnected and need to be addressed in tandem. Our results indicate that reaching a larger customer base is contingent on the price of the product and the price is contingent on economies of scale. Furthermore, the need to increase capacity may create additional challenges as upcycling firms are in many cases dependent on a complex and restricted supply chain. In the scaling up stage it also appears to be important to consider how large the company can grow, both from a sustainability and economic standpoint.

5.4 Complexity of Challenges and Connection to Business Models

In all three stages we can observe complexities in the way that challenges connect and impact each other as we have aimed to describe throughout this chapter. One example of this is the challenge of developing new processing technology when working with a novel ingredient. The challenge can be categorized as a technical challenge regarding lack of equipment, but it also entails challenges concerning the economic viability of the endeavor and sustainability concerns regarding energy consumption, among other things. Similarly, companies may address these challenges in a multitude of ways. The challenge might be of technical nature, but the solution can be found in working with new partnerships and collaborations that inhabit the technological expertise necessary.

Another factor increasing complexity is that the challenges vary depending on what strategic choices the company makes and what the business model of the individual company looks like. Using the same example as in the previous paragraph, the nature of the challenge differs depending on if the company is developing the product in-house or outsourcing production. This will affect if its main challenge is related to building collaborations with suppliers and manufacturers or related to technical development. This implies that the importance of various challenges likely will differ between different firms depending on their business model and circumstances.

Furthermore, our results indicate that there is no single correct response to a challenge; instead, consideration must be given to the specific circumstances and the company's business model.

One example of this from our study is connected to presenting a novel product to the market, where all three case companies employed different strategies for reaching out to their customers. Renewal Mill started out primarily with B2B sales and then later moved into retail. The Other Side of Coffee focused on farmers markets, conventions and mom-and-pop shops to reach out to customers in the early stages. Lastly, imPASTA focused on creating awareness among end-consumers by selling their products to meal-kit and food service providers. This showcases how a similar challenge can render varying responses from different firms.

The findings from our study highlight that it is essential that decisions are made in accordance with the company's business model. For example, the type of product a company is selling impacts what customer groups they have, which in turn affects what type of communication and channels are suitable to reach those customers. This emphasizes the importance of ensuring that all aspects of the business model are well-aligned from how the organization captures and creates value to how they deliver the value proposition to the customer.

6 Conclusion

The purpose of this thesis has been to increase the understanding of what challenges are associated with growing an upcycling business within the food sector. To achieve the purpose of the study, the following research question was constructed: What are the main challenges associated with developing and scaling up a business for upcycled food products, and how can firms handle these?

To answer the study's research question, a multiple case study of three upcycling companies within the food industry was conducted. Experts within the field of upcycling were also consulted to broaden the discussion and ensure a diversity of perspectives. In the study, challenges and strategies linked to three stages of developing and scaling up a business were investigated: product development, commercialization, and scaling up. Based on the empirical finding, Figure 4 was created, compiling prominent challenges within each of the three stages, and subordinating these under the six areas: customer perception, partnerships and collaborations, technology, regulations and food safety, sustainability, and economic viability. While structuring the results around six categories helped to shed light on challenges from different perspectives, we want to emphasize that a specific challenge not necessarily can be placed within one confined area.

Our study concludes that some of the main challenges associated with developing an upcycled product is finding a suitable side stream for upcycling, both from a sustainability perspective, but also that the side stream is approved for human consumption by law. Often there are also technical challenges with developing the product which means that companies need to invest a lot of time and money in R&D. Getting the taste and sensory aspects of the product right appears to be of particular importance and something that can often be a challenge for companies working with upcycling of food waste.

When commercializing the product, a lot of the challenges relate to how to reach out to customers and communicate the product offer. How companies communicate about upcycling seems to influence the way customers perceive the quality of the product, where word choices such as “underutilized food asset” or “rescuing food” seems to be preferable to “food waste”. While many

customers seem to appreciate the concept of upcycling, it appears that few are willing to pay a premium because of that factor alone.

A challenge for scaling up is that upcycling firms often depend on the demand for their suppliers' primary product, which can create supply chain uncertainties and limit the availability of the by-product. Furthermore, firms need to consider the economic and environmental impact when expanding their operations. Another challenge is connected to lowering the price of the products, which appears to be critical for upcycled foods to compete with conventional food alternatives and reach a larger customer base. However, economies of scale are typically necessary to reduce the price, and increased production volumes are contingent on customer demand, which illustrates one example of the interconnections between the challenges of scaling up.

6.1 Theoretical Implications

The findings of this thesis suggest several implications for academic literature. First, our research contributes to the field of upcycling, by enhancing the understanding of what challenges food upcycling companies face when developing and scaling up their business, and how firms can handle these. Since many challenges and strategies are company and industry specific, as highlighted by Zuccella and Previtali (2018), definite conclusions should not be drawn from a singular study. However, we believe our findings in combination with future research can contribute to an understanding of key challenges for the upcycling industry, and spark future research into strategies for their growth. By presenting key challenges and strategies associated with different stages of business development, and categorizing the challenges into six areas, our study provides a structured framework for future research to investigate challenges and strategies further.

Additionally, our study contributes to the field of business models. Bringing light to the different stages of business development, our study showcases that business models are dynamic entities that in many cases require continuous change to ensure the growth of a business. Moreover, our thesis points toward a close relationship between the challenges firms encounter and their business model design, emphasizing the need to study both simultaneously to fully understand the implications of the challenges and strategic choices.

6.2 Practical Implications

The results of this study also offer a number of practical implications for actors operating in the upcycling industry. First and foremost, our study provides guidance for food companies and entrepreneurs aiming to enter the upcycling industry or grow their current upcycling business. By compiling challenges associated with different stages of growth, our study highlights important aspects to consider in different steps of growing a business. While the more specific challenges are likely to differ between companies, we believe that the overall challenges highlighted in this thesis are something that most food upcycling companies need to consider. Since the challenges need to be understood in relation to the company and the context in which it operates, it is not possible to give a concrete answer as to how the challenges should be solved. However, we believe that the discussion provided in this thesis concerning the different ways of working and solving various challenges can provide companies with some guidance.

While our framework aims to describe challenges and strategies for upcycling companies within the food industry, we believe that our findings also can contribute to other CPG companies aiming to develop and scale up their business. For example, reaching out to customers and communicating about a product previously unknown to customers is a challenge for most companies launching a novel product. Likewise, many companies struggle with how to finance their operations and experience difficulties in convincing partners of the product's potential. Thus, we consider our thesis to have practical implications to companies of various types, even if not all challenges are applicable to all companies, and it is highly individual how the challenges should be solved.

6.3 Limitations and Future Research

Despite valuable insights gained from this study, there are some limitations that need to be addressed. First, we want to discuss some limitations regarding the generalizability of our results. Since our study encompassed only U.S. based companies operating primarily on a national level, further research into companies in other countries is necessary to investigate to what degree the findings presented in this thesis are generalizable to companies operating in other regions. Furthermore, all companies studied in this thesis were focused on upcycling from the beginning, entailing that many of the challenges they encountered were connected to developing their business

from scratch. It is likely that established companies that choose to incorporate upcycled products into their assortment, or make their existing products upcycled, will encounter other types of challenges. Challenges prevalent for these types of companies is thereby something that could be explored by future research. Additionally, our case companies were in the early stages of scaling up their operations. Thus, research into companies that have scaled up further would be necessary to provide more guidance on how firms can handle the challenges associated with reaching a larger scale.

To answer the research question, we chose to pursue a qualitative approach, which allowed us to explore and get an in-depth understanding of different challenges. While the aim of our study has been to get an understanding of some of the main challenges for upcycling companies, it does not investigate what challenges are most common. For this purpose, we believe a quantitative method is more suitable, and this could thus be an interesting area for future research. Furthermore, our thesis aimed to examine the challenges of scaling up upcycling companies from the companies' perspective. However, our findings suggest that other actors also have an important role in enabling the transition to more upcycled food products. This could thereby be an interesting area for future research.

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Appendix A

Interview Guide - Company Representatives

General Questions

- Could you describe your role and responsibilities within the company?
- How long have you worked at the company?
- How many employees are there in the company?
- What got you interested in working with upcycling?
 - Do you have any previous experience working with upcycling?
- Could you give us a brief description of the company's history?

Challenges and strategies associated with developing and scaling up the business

- What challenges did the firm encounter in the product development stage?
 - How has the company worked to address these challenges?
- Were there any challenges related to commercializing the product?
 - How has the company worked to address these challenges?
- What challenges has the firm encountered when trying to scale up the business?
 - How has the company worked to address these challenges?

Challenges related to the company's business model

- Could you describe the company's main customer groups and how do you communicate the firm's product offer to them?
 - Have you encountered any struggles related to this?
- Could you elaborate on the company's key partnerships and what these collaborations look like?
 - Have there been any challenges related to partnerships?
- Could you describe the firm's key resources and key activities?
 - Have there been any challenges related to accessing and/or processing the raw material used for upcycling?
- Could you tell us about the company's main revenue streams?

- Are there any challenges related to these revenue streams?
- Could you describe the cost structure of the firm?
 - Are there any challenges related to the cost structure of the company?

Reflections on the food upcycling industry

- How do you think upcycled food products can contribute to a more sustainable food system?
- What do you think are some of the keys for the upcycled food market to grow and compete with conventional foods?
- Do you have any other thoughts on the upcycling food industry or something else you would like to add?

Appendix B

Interview Guide - Industry Experts

General Questions

- What is your profession?
 - How long have you worked with this?
- What type of knowledge and experience do you have in regard to upcycling?

Challenges

- How do you think upcycled food products can contribute to a more sustainable food system?
- What do you think are some of the main challenges with:
 - Developing new upcycled food products?
 - Commercializing an upcycled food product?
 - Scaling up a business for upcycled food products?
- Are there any sustainability issues with the food upcycling industry?
- To what degree do you think that these challenges are unique for the upcycling food industry?

Strategies

- How do you see that upcycling firms work with scaling up their businesses currently?
 - Could you give some examples?
- How do you think that firms should or need to work to scale up their business?
- What do you think are some of the keys for the upcycled food market to grow and compete with conventional foods?
- Do you have any other thoughts on the upcycling food industry?
- Is there anything else you would like to add?