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A Work Project, presented as part of the requirements for the Award of a Master's degree in Impact Entrepreneurship & Innovation from the Nova School of Business and Economics.

Unlocking the Potential of Cascara with Impact Entrepreneurship: A Journey from
Coffee By-product to Market Innovation
Product Development Strategy

Lucas Obermeier

Work project carried out under the supervision of:

Prof. Anne-Laure Fayard

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Abstract

This work project explores the innovative transformation of Cascara, a by-product of coffee production, into a functional, health-conscious beverage while laying the groundwork for an impactful and profitable business. Among global challenges in the coffee industry, such as economic vulnerability, social inequities, and environmental degradation, Cascara emerges as a promising solution. The project identifies opportunities for economic empowerment of small-scale farmers, environmental conservation, and market innovation through Cascara's commercialization. The study follows a structured journey, addressing challenges and opportunities through diverse methodologies, ultimately identifying five key focus areas that got explored deeply: sourcing, product development, branding, sales, and finance. By adopting a circular value chain model, this work project aims to redefine the value chain, fostering sustainability and inspiring impact-driven entrepreneurship.

The individual field lab focuses on the product development strategy for the Cascara-based beverage (CBB), bridging the gap between prototyping and scalable production. Using the Beverage Development Framework (BDF) and expert collaboration, key challenges in recipe refinement and manufacturing feasibility were addressed. Iterative testing, ingredient optimization, and strategic production decisions informed a roadmap for further product development.

Keywords: Impact entrepreneurship, start-up, sustainability, consumer goods, Cascara, Cascara-based beverage, non-alcoholic beverage production

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Part I: Group Part

1 Introduction

Coffee is one of the most consumed beverages in the world, deeply embedded in cultures across all continents. With over 2 billion cups of coffee consumed daily, the global coffee industry plays an important role in supporting millions of livelihoods, particularly in coffee-growing regions such as Latin America, Africa, and Southeast Asia (International Coffee Organization 2020). However, despite the industry's size and importance, its production and trade are fraught with challenges. Climate change, volatile market prices and social inequalities contribute to the complexity and imbalance of the coffee industry (Haque 2023).



Figure 1: The Coffee Cherry

Most attention in the coffee industry is focused on the beans, but the coffee cherry itself is often overlooked. While the beans drive much of the global trade, the remaining part of the cherry, known as *Cascara* (See Figure 1), is typically discarded. Historically considered a waste product, Cascara has the potential to play an impactful role in the coffee sector, presenting an opportunity for innovation, sustainability, and added value to coffee farmers (Murthy, Pushpa and Naidu 2012; Iriondo-DeHond et al. 2020). This *work project* explores how Cascara can be turned from an underutilized by-product into a valuable and sustainable beverage ingredient, benefiting not only the environment, but also coffee-producing communities, and consumers.

2 The Foundation: From Problem to Solution

2.1 The Problem: Overview of the Coffee Industry and Small-Scale Farmers

The global coffee industry is increasingly facing challenges that extend beyond the simple production and trade of coffee beans. On the surface, coffee is a valuable commodity with global consumption continuing to rise (International Coffee Organization 2020). However, beneath this demand lies a deeply inequitable system that especially affects the large majority of small-scale coffee farmers in producing countries (Fridell 2007). These farmers are typically defined as those relying primarily on family labor, hand-picking their harvest, producing limited volumes of coffee, and lacking direct access to international markets (Montgomery 2023). In general, the global coffee industry is deeply rooted in history, and many farms have been passed down through generations. However, in recent years, large industrial farms have gained prominence, dominating the global market with low-cost coffee beans. Hence, small coffee farms have increasingly struggled to maintain a sustainable livelihood in the face of fluctuating market conditions, exploitative trade practices, bad working conditions, and changing climate patterns. The problem space can be described along three dimensions: the *economic*, *social*, and *ecological* factors of influence.

Economic Factors: The economic challenges facing coffee farmers stem from a range of structural issues that reduce their income potential and make them highly vulnerable to external pressures. A central issue is the fluctuation of global coffee prices. They are influenced by factors such as climate events in major producing countries, cartel dynamics, and the entry of new, large-scale producers (La Azotea, personal communication, 2024; Narayanan and Tomar 2024). For instance, when major producing countries like Brazil experience crop failures due to extreme weather, global prices can spike, benefiting some farmers temporarily but destabilizing others. Conversely, the rise of new producers like Vietnam, which exports large

volumes of lower-quality Robusta coffee, has flooded the market and led to price drops that disproportionately affect higher-quality producers in regions like Guatemala (Tadasse et al. 2016). This volatility is intensified by the power imbalance within the coffee supply chain. Small-scale farmers in countries like Brazil, Ethiopia, and Colombia often lack direct access to global markets. Hence, they are forced to sell their harvest to intermediaries called "coyotes". These intermediaries purchase coffee at prices below market value, capturing the majority of profits. Studies indicate that only about 16% of the final retail price reaches farmers, while importers, roasters and retailers in consuming countries claim most of the revenue (International Coffee Organization, 2020; Melo et al. 2014). This imbalance extends poverty and economic insecurity for coffee producers. Many of them are unable to cover rising production costs driven by increases in fertilizer prices and labor shortages (Perfecto and Vandermeer 2015). This dependency on coffee revenue traps many farmers in a cycle of economic vulnerability, reinforcing their reliance on intermediaries and leaving them with limited bargaining power (Nagel, personal communication, 2024).

Social Factors: The social challenges in the coffee industry are substantial, affecting the stability and well-being of farming communities. Due to the seasonality of coffee farming, the farmers and laborers primarily earn an income during harvest periods. This concentration of income often leads to rural exodus, where rural workers migrate to urban areas or other countries in search of more consistent work. This destabilizes local communities and weakens social ties as family members are frequently separated (Bacon et al. 2008; Jha et al. 2014). Moreover, coffee farmers and workers often lack access to essential social services, including healthcare, education, and social safety nets, which are often inadequate or entirely absent in many coffee-producing regions. This absence of social infrastructure increases vulnerability to exploitation and limits pathways to economic advancement (Hani 2024). In regions like Guatemala, labor shortages have emerged as another pressing concern. Migration, particularly

to the U.S., has significantly reduced the local labor force, compelling farmers to recruit seasonal workers from distant areas. This not only raises operational costs but also requires farmers to provide housing, often under challenging conditions, further straining the limited resources of small-scale farmers (Reher, personal communication, 2024).

Ecological Factors: The ecological challenges tied to coffee farming are largely rooted in unsustainable agricultural practices, which have severe repercussions for both local and global ecosystems. One of the primary issues is deforestation. As coffee demand grows, deforestation in coffee-producing regions directly contributes to global biodiversity loss, as coffee farms replace biodiverse forests with monoculture plantations that support far fewer species (Perfecto et al., 2019; Rice 2018). Soil degradation is another pressing concern. The intensive monoculture of coffee weakens soil fertility, as nutrient depletion and erosion become more prevalent over time (Cola 2023). To maintain yields, farmers often resort to synthetic fertilizers, which further degrade soil health. Additionally, pesticide and fertilizer runoff from coffee plantations pollute nearby water sources. This harm of aquatic ecosystems poses risks to communities dependent on these waters for drinking and irrigation (Soares et al. 2013; Knowlton 2023). Furthermore, the traditional disposal of Cascara after coffee processing contributes to environmental degradation (See Figure 2).

When discarded improperly, Cascara ferments release methane, a potent greenhouse gas, into the atmosphere. This decomposition also leads to soil acidification and water contamination. In Ethiopia, studies have shown that the improper disposal of Cascara significantly degrades river water quality, with decreased pH levels and oxygen content, impacting aquatic life and reducing biodiversity (Iriondo-DeHond et al. 2020).



Figure 2: Discarded Coffee Cherries in Guatemala

2.2 The Raw Material: Cascara

The name Cascara is derived from the Spanish term for “husk” or “peel”. It refers to the outer layers of the coffee cherry that surround the coffee bean and are typically removed during processing. Traditionally, Cascara has been used in Ethiopia, Yemen, and parts of Latin America as a tea-like infusion or “coffee of the poor”. Since nowadays coffee production focuses predominantly on the beans, nearly 90% of edible parts are discarded as organic waste, among them Cascara (Iriondo-DeHond et al. 2020). It has largely been overlooked as a resource within the broader coffee industry in industrialized countries (Schwarz, personal communication, 2024).

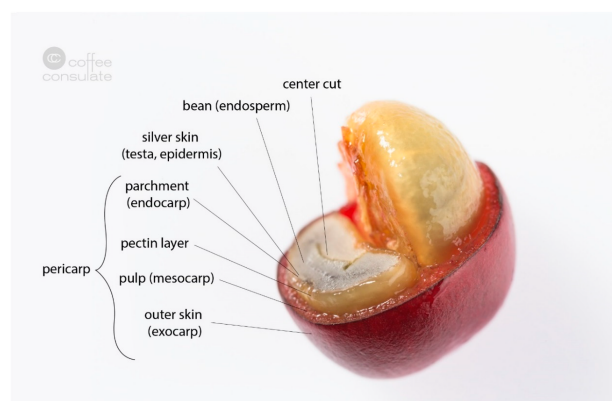


Figure 3: Anatomy of the Coffee Cherry

As seen in Figure 3, the coffee cherry has multiple layers: the exocarp or outer skin, the sweet-tasting mesocarp, and the parchment or endocarp that covers the bean itself (Iriondo-DeHond

et al. 2020). Cascara's composition varies based on the processing method and region, but it generally contains a range of beneficial bioactive compounds, including antioxidants, polyphenols, and dietary fiber (Esquivel and Jiménez 2012; Lestari et al. 2022). Nutritionally, Cascara has been found to contain between 44-50% carbohydrates, 18-21% fiber, 10-12% protein, and 2.5% fat, along with caffeine and antioxidants like chlorogenic acid (Heeger et al. 2017). Its chemical profile indicates significant health benefits, which are increasingly drawing attention in the food and beverage sectors. The ingredients position Cascara as a functional ingredient with potential immune-boosting and anti-inflammatory properties (ThisSideUp 2020).

2.3 The Opportunity: A Cascara-based Beverage

Through our research and conversations with coffee farmers in Mexico and Guatemala, we have discovered this untapped potential of Cascara. Using this by-product offers a promising solution to some of the coffee industry's deepest challenges, creating new opportunities for economic, social, and environmental sustainability. The recent shift in perspective on Cascara was significantly advanced in 2022, when the European Food Safety Authority (EFSA) granted approval for its use in non-alcoholic beverages as *novel food* in the EU. This regulatory milestone not only legitimizes Cascara as a safe ingredient in beverages but also opens doors for its large-scale commercialization (EFSA Panel on Nutrition et al. 2022). On top of that, Cascara is now being explored for a full approval across a variety of other product categories, including flour alternatives, jams, and even cosmetics. The EFSA approval elevates Cascara from a low-value by-product to a legitimate player in the global beverage market.

2.4 The Solution Design

The unique characteristics of Cascara in combination with the recent legal change offer a promising opportunity. Putting the nutrient-rich profile, natural sweetness, and moderate

caffeine levels in the context of the EFSA regulation, Cascara can become a strong competitor in the non-alcoholic beverage market, appealing to consumers seeking alternatives to traditional teas, coffees, and energy drinks (Iriondo-DeHond et al. 2020). Hence, we are developing a non-alcoholic Cascara-based beverage (CBB).

Below, Figure 4 illustrates our solution design, showing how we aim to transform the traditionally linear coffee value chain into a circular model. By upcycling Cascara into a beverage ingredient, we take the first step in challenging the status quo. To fully close the loop, our future vision also considers downcycling options, such as converting remaining Cascara into biogas or fertilizer.

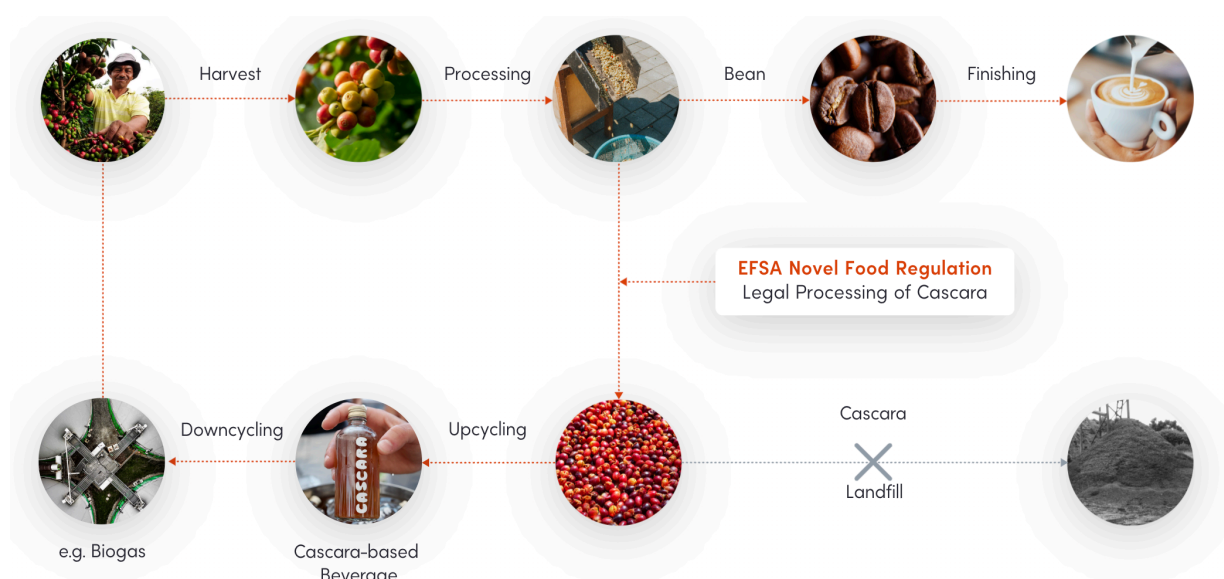


Figure 4: The Solution Design

As Figure 5 shows, this approach addresses several intertwined economic, social, and ecological challenges within the coffee industry.

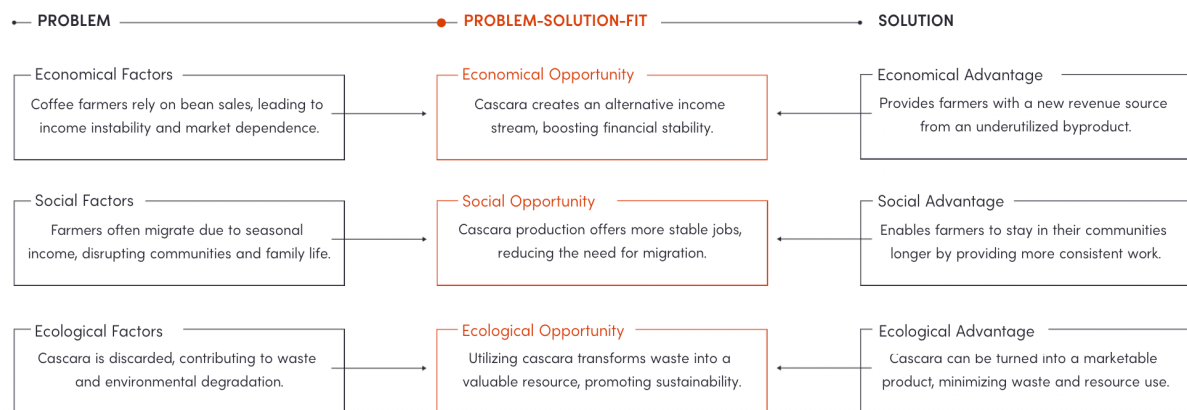


Figure 5: Problem-Solution-Fit with the use of Cascara

Economically, the commercialization of Cascara enables small-scale coffee farmers to diversify their income stream, decreasing their dependence on coffee bean sales and mitigating the risk of volatile coffee prices. This transformation can help stabilize rural economies by reducing farmers' dependency on a single, fluctuating commodity and encouraging a more sustainable livelihood.

Socially, Cascara's commercialization offers a solution to the income challenges faced by small-scale coffee farmers. By creating demand for Cascara products, farmers gain a more consistent workload, reducing the necessity for seasonal migration in search of alternative employment. This continuity can strengthen local communities by maintaining family units and stabilizing the rural workforce.

Ecologically, the utilization of Cascara helps to address the environmental issues stemming from its improper disposal. Repurposing Cascara into marketable products reduces this organic waste, transforming an ecological liability into an asset. This practice not only minimizes environmental pollution but also supports global efforts in reducing the carbon footprint of coffee production.

2.5 The Intended Impact: Sustainable Development Goals

A core component of our solution design is the impact we intend to achieve with our business model. Addressing interconnected economic, social, and environmental challenges within the

coffee industry associates closely with several Sustainable Development Goals (SDGs) formulated by the United Nations, particularly SDG 8, SDG 12, and SDG 17.

SDG 8: “Promoting sustained, inclusive and sustainable economic growth, full and productive employment, and decent work for all” (United Nations 2024).

Providing small-scale coffee farmers with a new revenue stream aligns with Target 8.2 on increasing productivity through diversification. Additionally, our model helps stabilize local employment, reducing the need for seasonal migration (Reher, personal communication, 2024), and aligns with Target 8.8 on promoting safe and stable working conditions.

SDG 12: “Ensuring sustainable consumption and production patterns” (United Nations 2024).

Turning Cascara into a valuable resource supports Target 12.2 by promoting resource efficiency and Target 12.3 by reducing post-harvest waste. Our approach also contributes to Target 12.5 by embracing a circular economy model, where waste is minimized, reducing environmental pollution and promoting sustainable production practices (Iriondo-DeHond et al. 2020; Eckhardt et al. 2022).

SDG 17: “Strengthening the means of implementation and revitalizing the Global Partnership for Sustainable Development” (United Nations 2024).

Finally, by participating in the creation of an international market for Cascara, our project supports Target 17.1 by strengthening domestic resource mobilization. Partnerships with local cooperatives and international intermediaries expand market access and contribute to Target 17.11 by reinforcing economic resilience, promoting fair trade and increasing the global market share of developing regions (Nagel, personal communication, 2024).

Through these intended contributions to SDG 8, SDG 12, and SDG 17, our solution design aims to represent a sustainable and impactful business model that addresses the economic, social, and environmental challenges in the coffee industry. This alignment with global sustainability goals is our vision for creating meaningful benefits for coffee farmers and the environment.

3 Work Project Guidance and Applied Methodologies

Before delving into the core of this work project, it is important to first provide a clear guide on how to navigate this document. This chapter outlines the methodologies, structure, and research approach employed throughout our work project. This overview is intended to not only facilitate understanding but also to highlight how each section contributes to our goal of launching a viable CBB venture.

This work project centers on applied research to address specific Knowledge Gaps (KG) and create actionable insights that directly support our business development and decision-making. In essence, this work project adopts a practical approach with the aim of launching a real-world venture. Designed as a roadmap for introducing a CBB to the market, this work project serves as both a development guide for our business model and an informative resource for potential investors seeking insights into core activities.

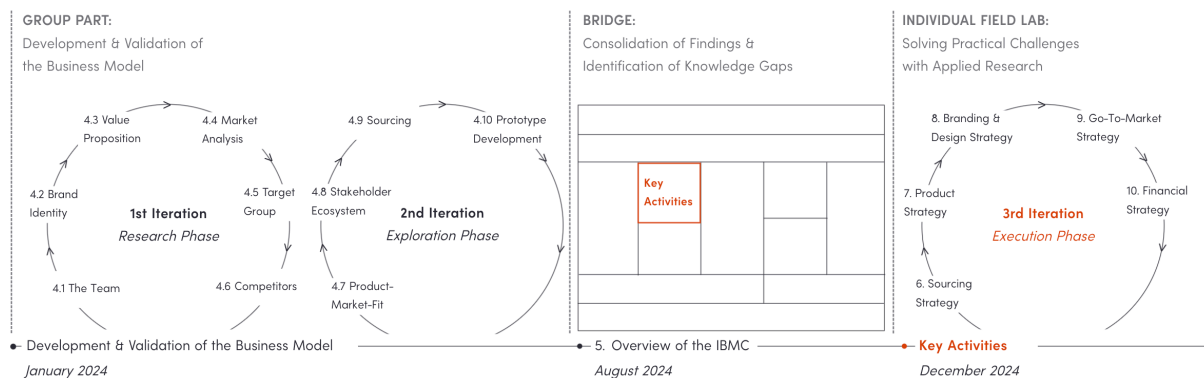


Figure 6: Guiding Overview on the Structure of the Work Project

Work Project Structure: Figure 6 outlines the structure of this work project. It starts with a group part, including two iterative development cycles that cover key practical advancements and insights gained, up to the start of the *Individual Field Labs*. To improve readability, these insights are organized by themes rather than exact chronological order. After these cycles, the results are visually summarized in an *Impact Business Model Canvas* (IBMC). The IBMC was

chosen for its structured approach to holistically evaluate and refine our business model, allowing us to consolidate learnings and identify knowledge gaps that could impact our venture's success. Mapping out key components of our business model, the IBMC not only clarifies our strategic direction but also highlights areas that require further research. In detail, this analysis reveals unresolved knowledge gaps in the *Key Activities* section of the IBMC. These knowledge gaps guide the practical research goals for the *individual field labs* and will be addressed in a third iteration, representing our individual research contributions.

Applied Methodologies: The applied research methodologies used along the three development cycles include a blend of qualitative and quantitative methods. To give a broad overview of the approaches, these methodologies are mapped in Table 1.

Table 1: Overview of Applied Research Methodologies

Methodology	Applied Research Activity	Quantity	Purpose
Quantitative	Secondary Desk Research	N/A	Business Model Validation
	Customer Interviews	41	Customer insights: consumption patterns & preferences
	Stakeholder Interviews	10	Problem space: farmer challenges, value chain analysis
	Expert Interviews	41	Cascara value chain, Beverage creation, Brand Building
	Tasting Surveys	3	Prototype refinement; Target taste insights
Qualitative	Lab Work	N/A	Data-based Raw Material & Recipe Testing
	Prototype Tastings	8	Real-life feedback; data-driven improvements
	Field Trip	2	Problem space: Coffee farm field research
	Secondary Desk Research	N/A	Cascara background; regulatory overview

An overview of all interviewees with additional information is shown in Appendix D. Detailed explanations of the methodologies used are provided in each individual field lab chapter. The findings from our research are presented in dedicated chapters that illustrate how the learnings helped shape a viable business model and contributed to fill our knowledge gaps.

Knowledge Gaps and Research Goals: The main purpose of this work project is to address these knowledge gaps through five distinct applied research goals, each focusing on a specific

area crucial to the success of our project. Every research goal is approached individually, with each part of the research standing alone to ensure that it addresses a specific identified gap. This modular structure allows readers, including potential stakeholders or investors, to easily locate and understand each research section independently. In conclusion, this field lab approach underscores our goal to use applied research methods to address real-world issues with practical, data-driven solutions.

4 Development and Validation of the Business Model

4.1 The Team

In April 2023, part of our team traveled to Latin America to explore the origins of one of our shared interests: coffee. After visiting several coffee farms in Guatemala, El Salvador, and Mexico, we not only had the opportunity to taste Cascara for the first time but also experienced firsthand the environmental and economic challenges faced by coffee farmers (See Chapter 2.1). From that moment, one question persisted: "How is it possible that such a superfruit remains largely unknown in Europe?".

Having previously collaborated on various university projects, we already recognized strong synergies in our work ethic and ambitions. Simultaneously, our diverse backgrounds and interdisciplinary skills enriched our collaboration, as each of us brought unique experiences to the table. These experiences made us an ideal team for the final entrepreneurial project within the master's program. While brainstorming several topics, the untapped potential of Cascara immediately resonated with all of us, aligning perfectly with our shared interests and values. United by our passion for coffee, impact-driven business models and the creation of a tangible product, we quickly realized that our ambitions to launch a startup in Germany were seamlessly aligned. Building on this foundation, we formed the *Cascara Collective*. A short description of each team member's role and individual background is shown in Figure 7.



Figure 7: Team Member's Area of Expertise

4.2 Brand Identity

Haas (personal communication, 2024) said “In the beverage sector it is just about branding – that’s the most important job you have” (See Appendix D). Following this advice, our goal was to develop an authentic brand identity rooted in the core values and shared purpose of our founding team. By using our internal identity as a baseline, we aimed to create a strong, unified strategy that would finally translate into our external brand presence. This chapter outlines the strategic approach we took, focusing on the stages of development and the key milestones we achieved along the way.

Figure 8 illustrates the key elements of our branding strategy. This framework is constructed from the inside out, aiming to establish a robust foundation that ensures cohesiveness as the project grows. Based on our “why”, we defined shared values that are incorporated in the company culture (Sinek 2009). Building on this internal identity, we subsequently articulated brand character themes, promises, and positioning to effectively convey this identity to the outside.

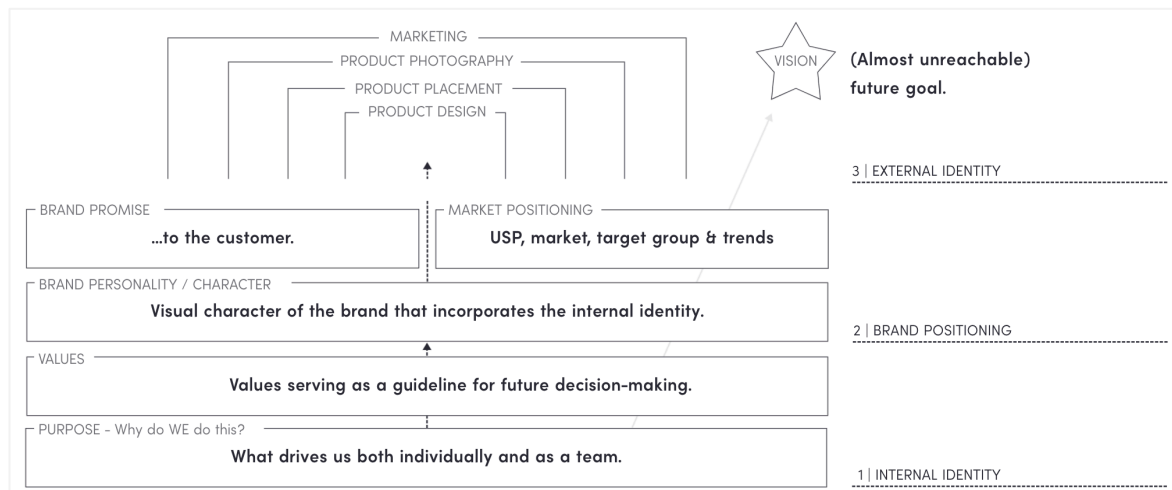


Figure 8: Structured Process of the Identity Development

Stage 1: Establishing our Internal Identity

Our Purpose: In the context of new venture creation, research emphasizes the importance of a founding team aligning around a shared purpose and passion. This alignment fosters a cohesive organizational culture and supports effective decision-making, which is essential for a startup's success (Murnieks et al. 2016). It forms the foundation of a brand's core identity, particularly during the early stages of development, as the founders' purpose often translates directly into the company's vision (Sinek 2009). Figure 9 shows our common intrinsic drivers.

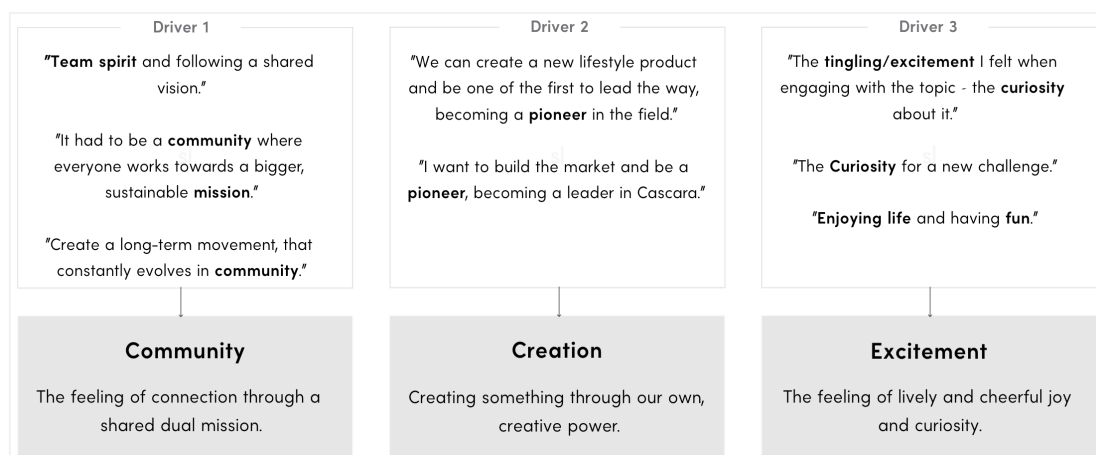


Figure 9: Key Drivers leading to the Purpose Statement

Identifying these three core motivations was essential for shaping our brand purpose. They brought together our individual aspirations into a unified, long-term direction. The goal was then to establish a central idea that would not only guide us as founders but also sustain our

enthusiasm over the long term. As illustrated in Figure 10, this reflection resulted in the articulation of our final purpose: “*We create what excites.*”

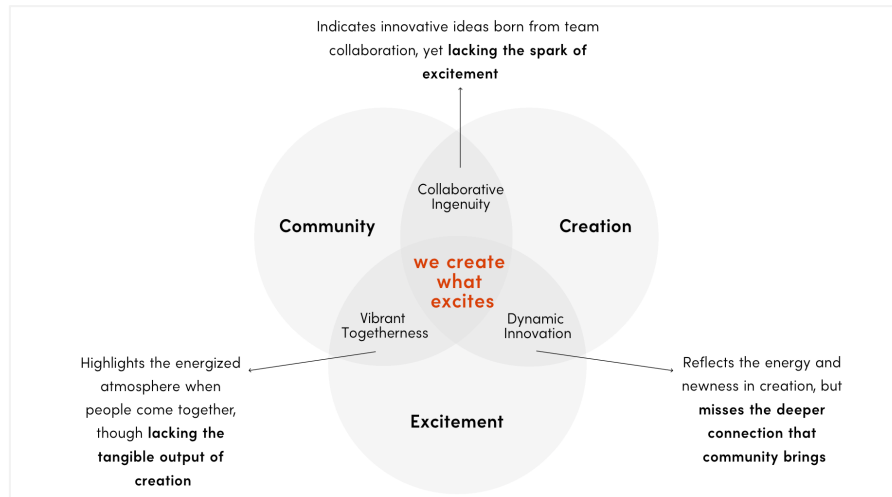


Figure 10: The Brand Purpose

This phrase captures the essence of our shared mission, embodying the excitement, creativity, and communal effort that we want to bring to the market.

Our Values: According to Schjoedt et al. (2013), shared values within a founding team are a critical element for successful collaboration and long-term decision-making in new ventures. These values are designed to influence not only how we behave internally but also how we interact with our external stakeholders and navigate growth. We ultimately identified four key values:

1. **Confidence:** This value embodies being *bold* and *cheeky*. It is inspiring and lively and drives creativity. Confidence allows us to take risks and push boundaries.
2. **Honesty:** This reflects being *authentic* and *enthusiastic*. We strive to bring fun into everything we do, creating a culture of transparency and openness.

3. **Curiosity:** With a focus on *inventiveness* and *eagerness*, curiosity drives our desire for growth and transformation. It represents the desire for progress and a better future. The longing for change and improvement guides our path forward.
4. **Community:** This value highlights *empathy* and *friendliness*. We aim to foster an environment of collaboration and support especially in terms of building the bridge between coffee producers and our consumers.

Stage 2: Developing our Brand Positioning

The Brand Personality: The brand personality plays a central role in shaping how audiences perceive and connect emotionally with a brand, bridging the gap between internal values and the public image (Geuens et al. 2009). With this goal in mind, we identified the human characteristics that should be associated with our brand, which are the following: authentic, impactful, natural, sexy, light-hearted, friendly, surprising, sun kissed, young, and bold.

The Brand Promise: Murnieks et al. (2016) emphasize that a strong brand promise is derived from the founding team's ethical principles, which promotes trust and loyalty among stakeholders and customers alike. This perspective goes beyond simply establishing a brand image: it focuses on conveying our values transparently and without tending towards greenwashing. This highlighted the necessity for incorporating our vision of mutual benefits along the value chain:

1. Farmers, who gain additional income and reduce organic waste.
2. Consumers, who receive a healthy and functional beverage.
3. Our brand, which fosters a growing community that reinforces this cycle through increasing sales.

Based on these aspects, the overarching promise emerged: *we promise to create a community where everybody wins*. This statement will serve as a guiding principle for future strategic decisions and help us anchor our focus on social impact deeply.

In conclusion, our internal identity and brand positioning form a solid foundation for our external brand identity, stage three (See Chapter 8). This foundation will serve as the baseline for future growth, guiding both our brand design and broader strategic decisions.

4.3 Value Proposition

Our value proposition (VP) is based on three core pillars: Customer Expectations, Economic Empowerment and Ecological Advancements. Through iterative, feedback-based development, we established our core VP that creates a cohesive and compelling message for our product:

“We transform Cascara, the often-overlooked coffee cherry, into a healthy and energizing beverage empowering traditional coffee farmers financially, embracing a circular economy approach by minimizing organic waste.”

4.4 Market Analysis

The global non-alcoholic beverage market has undergone significant transformations over the past decade. This chapter provides an overview of this market, with a focus on both global dynamics and specific trends in Germany. Germany offers a strategic market for our analysis due to several factors. The entire team is based in Germany, bringing valuable local knowledge, an existing network of contacts and understanding of the market dynamics. Moreover, Germany is one of the largest non-alcoholic beverage markets in Europe, characterized by significant growth potential (Statista Market Insights 2024). By examining the current landscape and emerging trends, we aim to highlight the market potential for innovative products, such as a CBB, and the forces shaping consumer behavior in this sector.

Overview of the Non-Alcoholic Beverage Market (Global and Germany-Specific): The non-alcoholic beverage industry is a dynamic and competitive space, with established brands and new entrants competing for market share. The market shows a wide range of water-based beverages to which flavor-enhancing additives (such as sugar, sweeteners, minerals, fruit flavors, etc.) are added. This category includes cola drinks, lemonades, energy drinks, fruit nectars, beverages containing fruit juice, and flavored mineral waters (Statista Market Insights 2024). These products cater to different consumer preferences, making this sector a broad and evolving space.

Consumer Behavior and Preferences: In Germany, non-alcoholic beverages (NAB) have seen a consistent increase in consumption, particularly in categories that align with current consumer values. According to recent studies, three dominant trends shape the non-alcoholic beverage market: sustainability, health awareness and functionality (Schienkiewitz et al. 2020; Gupta et al., 2023; Rodriguez-Sanchez and Sellers-Rubio 2021).

1. *Sustainability:* Sustainability has become a cornerstone of the beverage industry, driven by consumer demand for products that are both environmentally and socially responsible. Rodriguez-Sanchez and Sellers-Rubio (2021) emphasize that consumers are increasingly considering the environmental impact of their purchases, with many willing to pay a premium for products that prioritize sustainability. This includes not only the ingredients and production methods but also packaging and supply chain transparency. Consumers show a growing preference for Fair Trade products (Rodriguez-Sanchez and Sellers-Rubio 2021). In conclusion, companies are increasingly focusing on cleaner production methods, ethical sourcing, and minimizing environmental impact to appeal to eco-conscious consumers.

2. *Health Awareness:* As consumers become more aware of the link between diet and health, the demand for beverages free from artificial ingredients has risen significantly. Health-

conscious consumers are increasingly selective about the ingredients in their beverages, favoring products that are natural, plant-based, and free from artificial additives (Gupta et al. 2023). The German market reflects similar global trends, with a particular emphasis on reducing sugar content and artificial ingredients. Soft drinks are facing reduced demand as consumers shift towards healthier alternatives like flavored water and functional beverages (Schienkiewitz et al. 2020). Essentially, younger consumers are more inclined to consume juices and flavored water, while older demographics favor traditional drinks like coffee and water. This generational shift highlights the growing market for beverages that serve to diverse health needs, a trend reflected across Europe as well (Schienkiewitz et al. 2020).

3. **Functionality:** The functional beverage market is one of the most rapidly expanding segments in the food and beverage industry. In 2023, the global market for functional beverages alone reached \$208.13 billion (Gupta et al. 2023). In average, the market for functional beverages is expected to grow by 9% CAGR worldwide (Hilton 2023). This growth is largely fueled by a rise in health-conscious consumers who are looking for beverages that offer additional health benefits, such as energy boosts, cognitive enhancement, or immune support (Nazir et al. 2019).

Based on these trends, we turn our focus to the market data to assess the growth potential of the non-alcoholic energy and sports drinks segment.

The European non-alcoholic energy drink and sports drink market has shown strong growth in recent years. In 2018, the combined market revenue in Europe was €17.79 billion, which grew to €28.73 billion by 2023. Projections indicate that the market will continue to expand, reaching approximately €43.20 billion by 2029. In Germany, the market size increased from €2.53 billion in 2018 to an expected €9.83 billion by 2029. This growth corresponds to a Compound Annual Growth Rate (CAGR) of 6.76% for Europe and 10.27% for Germany over the period from 2018 to 2029, reflecting a robust demand in both markets (Statista Market Insights 2024).

The Total Addressable Market (TAM), represented by the total European market, amounts to €43.20 billion by 2029. The Serviceable Available Market (SAM), or the market specific to Germany, is projected at €9.83 billion for the same year. Finally, the Serviceable Obtainable Market (SOM), which represents a potential market share of 1-5% in Germany, translates to an estimated range of €98.3 million to €491.5 million by 2029. These figures underscore the substantial market potential within the non-alcoholic energy and sports drinks segment, especially given the in-scope categories of non-alcoholic energy drinks and sports drinks (Statista Market Insights 2024)

For a CBB, the opportunity lies in meeting the market demand for natural, healthy, and sustainable products that align with consumer values. This environment presents a favorable landscape for the introduction of innovative, functional beverages that cater to the evolving needs of health-conscious and environmentally aware consumers.

4.5 Target Group

Given these market trends, it is essential to provide an overview of the key characteristics and preferences of the target audience within this landscape. The final target group was defined through a process, as seen in Figure 11.

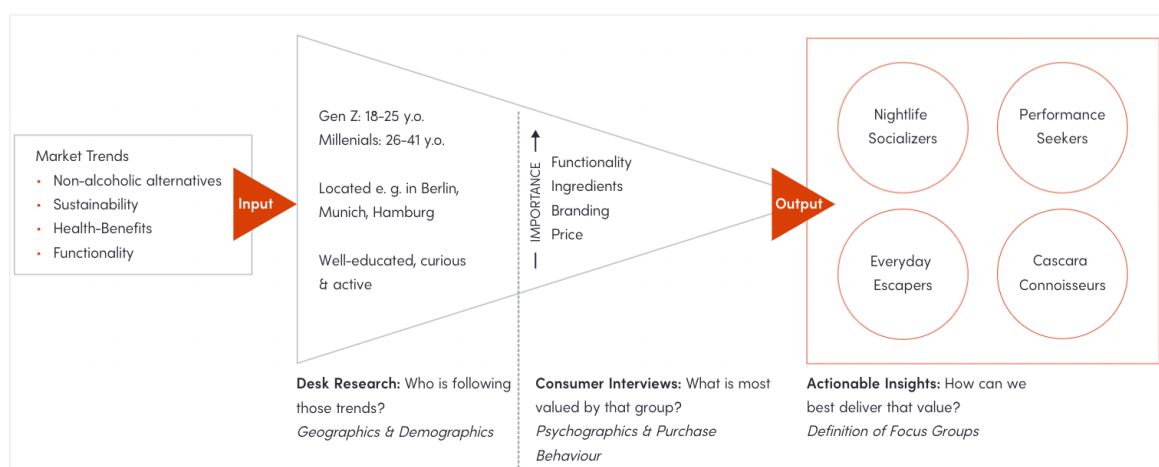


Figure 11: Process of Identifying the Target Group

Geographics and Demographics: The target audience in Germany consists of primarily younger urban residents, specifically Gen Z (ages 18–25) and then Millennials (ages 26–41), concentrated in metropolitan areas such as Berlin, Munich, and Hamburg (McKinsey and Company 2023; Euromonitor 2024). They tend to be well-educated and often choose beverages that align with their active lifestyles (Schienkiewitz et al. 2020).

Psychographics and Purchase Behavior: Subsequent consumer interviews (See Appendix A) allowed us to test the following hypotheses on consumption behavior trends, gaining valuable insights from a real-world context:

1. Consumers are regularly seeking alternatives to existing caffeinated drinks.

Caffeinated drinks are consumed daily, with the choice of drink type depending on the timing and purpose of consumption. Therefore, it is important to clearly define how, when, and where the target group would benefit from an additional caffeinated alternative.

2. The primary factors influencing consumer purchase behavior are health benefits, followed by functionality and environmental impact.

Preferences for functional, healthy ingredients are evident and environmental impact influence purchase decisions less than anticipated. Branding, ingredients, and design are also important, whereas taste and price are critical factors (See Appendix O).

3. Consumers are open to experimenting with new products they are unfamiliar with, especially in the context of a familiar category.

Consumers are selective and require clear benefits, such as health advantages, appealing taste, or attractive packaging. Recommendations from trusted sources or local support increase their openness to trying new products.

These understandings and additional psychographic insights are provided in both the *Customer Exploration Maps* and *Empathy Maps* in Appendix A, to gain a deeper understanding of our target group's motivations, behaviors, and pain points. The key takeaway here is that the

purpose and role of our beverage must be communicated very clearly. Consumers need to know when, where, how, and why to choose our drink, as well as the benefits it offers them.

Focus Groups: To address these diverse needs, we have identified four focus groups within our target group, each representing a distinct context and highlighting the unique role our beverage can fulfill.

- ***Performance Seekers:*** This group includes sporty individuals who seek out products that enhance their physical performance and energy levels.
- ***Everyday Escapers:*** This group seeks out beverages that provide joy and pleasure in everyday moments, for no greater reason than to have a refreshing drink with a satisfying taste.
- ***Cascara Connoisseurs:*** This group consists of coffee lovers and connoisseurs who value premium products. They are likely to appreciate sustainable sourcing and flavor profile of a CBB.
- ***Nightlife Socializers:*** This group is centered within the party and nightlife scene. They are frequent participants in music festivals, parties, and other social events where staying energized and alert is key.

Defining these focus groups helps us determine the best actions to reach potential customers within our target audience.

4.6 Competitors

For start-ups, a competitor analysis is essential to provide insights that inform market positioning or differentiation. As noted by Czepiel (2020), a competitor analysis is not a one-time activity but an ongoing process. Since Cascara-based products are new to the market, it is important to gain a high-level overview on adjacent categories that could influence our business activities in a broader sense. Therefore, our general competitor overview is structured into four

distinct clusters: direct competitors, indirect competitors, substitute products and beverage corporates, as seen in Figure 12. In the following, there is a brief description of these categories:

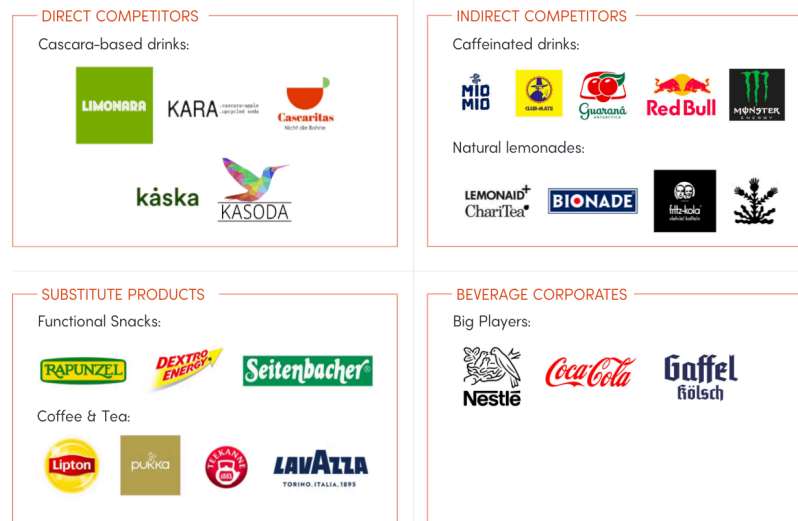


Figure 12: Broad Overview of Competitors Along Several Dimensions

- **Direct Competitors:** These companies represent our direct competitors that are producing CBBs as well. However, CBBs are still an emergent category, and all companies are operating on a relatively small scale.
- **Indirect Competitors:** These include other caffeinated drinks and natural lemonades. While not identical products, these beverages compete for a similar consumer base.
- **Substitute Products:** Functional Snacks, coffee, and tea are traditional alternatives that consumers might choose instead of our product, especially in terms of health and functional benefits. This cluster helps in understanding broader consumption patterns and potential market shifts.
- **Beverage Corporates:** Large beverage companies such as Coca-Cola or Nestlé dominate the beverage market, and while they are not direct competitors, their scale, distribution capabilities, and potential to enter niche markets like Cascara beverages are important considerations.

Since direct competitors are the biggest threat in the market (Delivered Social n.d.), an in-depth analysis helps gaining actionable insights for launching our product. Table 2 provides a detailed comparison of five active Cascara beverage brands along different categories.

Table 2: In-Depth Analysis of Direct Competitors

Company	Value Proposition for Consumers	Design	Price per liter	Location	Sales Channels	Ingredients (besides Cascara)	Followers on Instagram	Supply Chain	Target Group	Additional Insights
Cascartas	Coffein focused, fruity / refreshing drink	colorful, main color orange, South-America Vibe	7,03 €	Bielefeld	Online, LEH, Cafés, smaller local events	Cane sugar, lemon juice	863	Importeur: Knauer	young, energized, 18+	Biggest Player in the market, recent batch: 15.000 bottles
Kaska	Super-fruit, healthy because of Antioxidantes and iron, everything is natural	Mindful, sterile, clean, minimalistic	10,61 €	Berlin	Online, cafés, offices, bar, restaurants, private events	Lemon juice, ginger, agave	530	Importeur: Knauer	healthy, mindful, people who care about quality, 25+,	Entered the market recently
Limonara	Something new, made out of the coffee cherry, sustainability, support of the coffee farmers	colorful, coffee cherry as a design	-/-	Munich	Only per DM / Mail, Cafés	Lime, agave	303	-/-	30+, healthy, sustainable	Right now you can only purchase through DM / Mail
Kara Limo	Sustainability, using of waste products - upcycling	clean, minimalistic, similar to Kaska	8,50 €	Frankfurt	Cafés, Kiosks, Wine bars, SuperCoop	Apple and lemon juice	493	-/-	30+, healthy, sustainable	Right now you can only purchase through DM / Mail
Kasoda	Coffein focused, fruity / refreshing drink, something new due to Cascara	colorful, bright, South-America Vibe	7,80 €	Stuttgart	Local cafés, restaurants, smaller events (Vineyard events)	Sugar, Lime and lemon juice	280	-/-	young people, looking for alternative to caffeine, healthy	-/-

As noted, maintaining this analysis as an ongoing process is important, especially as we operate in an emerging market. Although the market for CBBs is still in its early stages, the current analysis provides valuable learnings to help shape our strategy:

1. Direct competitors emphasize only one key benefit of Cascara.
2. Their branding highlights natural elements, especially the coffee plant.
3. Their recipes show minimal variation.
4. Their sales channels show minimal variation, with a clear focus on Cafés.
5. It is not clear, who is consuming when and where - only a broad target group (no clear persona).
6. Market is largely unsettled.

The main learnings make clear that there is an unused potential of leveraging the combination of Cascara's benefits in one drink. This offers the opportunity to become a leader in this new category through uniting joy, functionality and sustainability. This competitor analysis helps us to position our CBB effectively by identifying market gaps and opportunities for differentiation, as stated in our Product-Market-Fit below.

4.7 Product-Market-Fit

Figure 13 provides an overview of how our VP addresses an underserved need in the beverage market that competitors have not yet met.



Figure 13: Product-Market-Fit

It becomes clear that our product fulfills the market's need for a beverage that not only offers health benefits but also brings joy through its functionality (such as caffeine) and allows for guilt-free consumption - without concerns about harming the environment, others, or oneself. Covering this need with the usage of Cascara, we are introducing a new category of beverage that remains largely unexplored, with only five competitors operating on a very limited scale. Compared to direct competitors, we differentiate with a recipe enhanced by specific ingredients that boost functionality, such as higher caffeine levels or antioxidants, allowing our beverage to align perfectly with current market trends (See Chapter 4.4). Furthermore, we identified a crucial gap: existing Cascara brands fail to clearly communicate the role and purpose of consuming a CBB. By targeting a precise focus group or concrete persona and educating consumers about the specific benefits of our drink, we can acquire early adopters and cultivate first customers. Figure 14 shows our initial positioning within the previously defined focus groups, based on our internal brand identity. This targeted approach enables us to experiment continuously for an iterative product market validation.

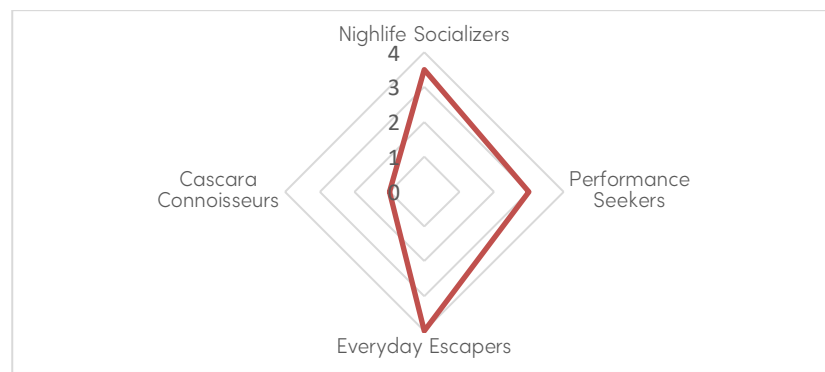


Figure 14: Focus Group Positioning

With this understanding, we can develop an appropriate beverage, a tailored branding strategy (See Chapter 8) and a targeted Go-to-Market (GTM) strategy (See Chapter 9) to strengthen the product-market-fit.

4.8 Stakeholder Ecosystem

To understand our stakeholder ecosystem, Figure 15 outlines every step of the value chain to identify key stakeholders and their relationships with us. The following analysis along the value chain allows us to define our regional ecosystem:

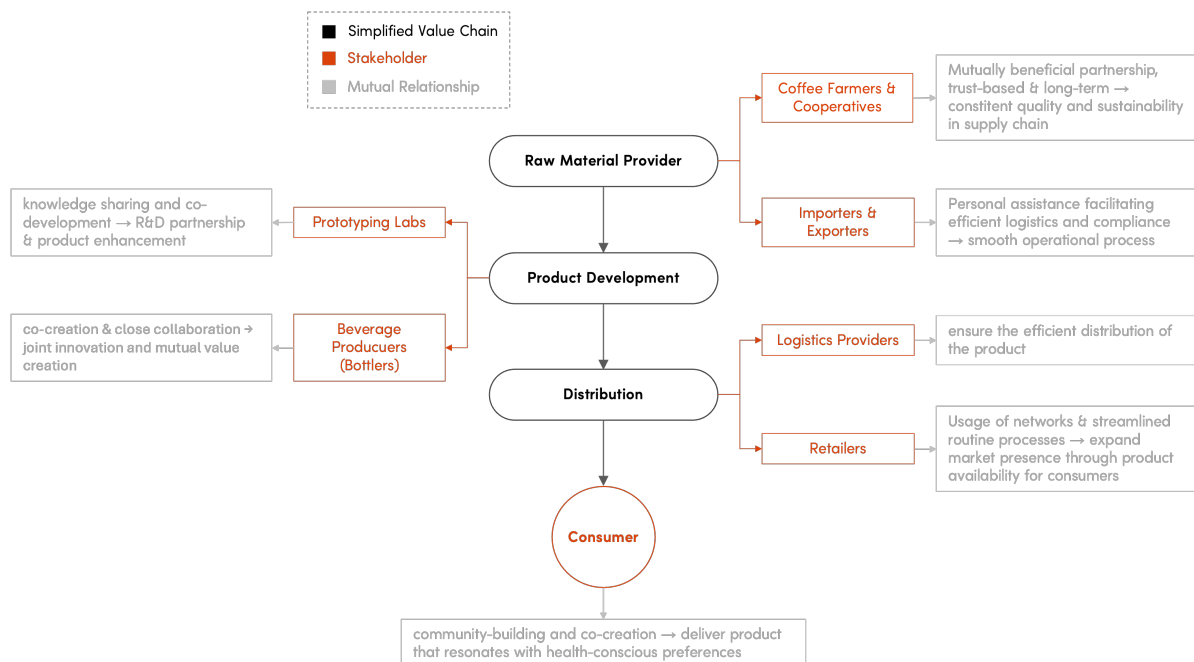


Figure 15: Stakeholder Ecosystem and Relationships

Coffee Farmers & Cooperatives: Coffee farmers and cooperatives are the primary stakeholder for Cascara sourcing. Farmers grow and sell coffee to cooperatives, which then aggregate and export it themselves or collaborate with Importers, providing another sourcing option, especially for European companies (See Chapter 6).

Importers and Exporters: Importers and exporters act as intermediaries in the supply chain, ensuring the smooth transit of Cascara from its country of origin to Germany. They manage customs clearance, quality control, and logistics coordination, enabling the product to reach European markets efficiently.

Prototyping Labs: Product development requires collaboration with laboratories or specialized food development companies. These partners help formulate the recipe and ensure it complies with all relevant regulatory standards. This step is foundational, as no bottling process can begin without a well-defined and compliant beverage base.

Beverage Producers (Bottlers): Once the beverage formulation is complete, the next essential step is bottling. These facilities are responsible for ingredient preparation, brewing method, carbonation, bottling, labeling, and packaging, while ensuring compliance with deposit systems, like Germany's recycling system. The result is a beverage in a bottle, ready for transport and distribution.

Logistics Providers: Furthermore, there might be additional stakeholders for storage, distribution and logistics, if these services are not covered by the bottler. However, an integrated approach where a single partner can manage multiple stages of the process may be beneficial.

Retailers: Retailers play an important role in offering our product directly to consumers. These might include supermarkets, health food stores, and specialty beverage shops. Retailers not only provide shelf space but also contribute to consumer education and promoting the product's benefits.

In the first two stages of the value chain, sourcing and product development, we already made significant milestones, which will be further detailed in the following chapters. However, it is important to note, that our stakeholder ecosystem extends beyond the value chain. For a holistic overview the inner system including internal stakeholders as well as the outer system, which covers external stakeholders that are not directly part of the value chain need to be considered too (See Appendix B).

4.9 Sourcing: Raw Material Provider

Understanding the value chain of Cascara begins at its source and starts with the coffee plant and the farmers in the countries of origin. During our visits to coffee farms in Mexico and Guatemala, we observed that Cascara's availability is closely tied to the coffee harvesting process. Despite its abundance, most farms overlook Cascara due to limited knowledge, infrastructure and market demand. However, some innovative cooperatives and farms are beginning to see its potential, adopting diverse approaches to sourcing. The underlying process of how Cascara is sourced can be seen in Figure 16 below.

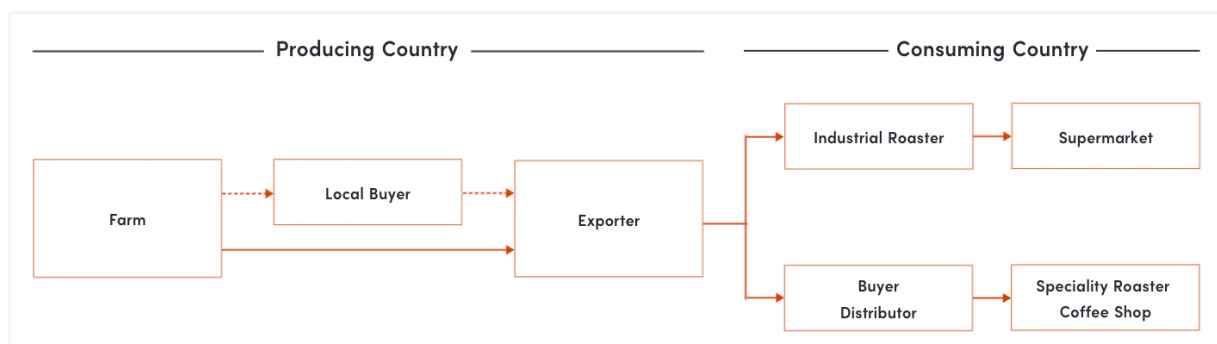


Figure 16: Supply Chain of Sourcing Cascara

Based on our field research, we have dived deeper into the model and identified three different primary sourcing models: *Direct Sourcing*, *Indirect Sourcing*, and a *Hybrid Partnership-based Model* (See Chapter 6). Each presents unique opportunities and challenges, which are presented in the following.

Direct Sourcing: This model involves working directly with coffee farmers to source Cascara. It provides full control over quality and ethical practices but requires significant investment in infrastructure, training, and relationship building. Farmers need support to develop the necessary processes for hygienic drying, storage, and preparation for export. Despite these challenges, direct sourcing can foster strong partnerships and ensure that farmers receive a fair share of the profits.

Indirect Sourcing: Sourcing Cascara through importers offers a lower entry barrier. These entities have already established supply chains and handle the complexities of export logistics. However, this model often lacks transparency, and the origins of Cascara may not align with sustainability and ethical sourcing goals. Additionally, farmers may continue to receive lower profits, extending economic challenges.

Hybrid Model: This approach blends the benefits of direct and indirect sourcing by working with ethically aligned intermediaries such as cooperatives or companies like *ThisSideUp*. These organizations offer a middle ground, providing the infrastructure and market access of indirect sourcing while maintaining high sustainability and ethical standards. They invest in farm development, support regenerative agriculture and ensure fair pricing.

Sourcing Challenges: The journey of Cascara from farm to market involves critical steps in processing and logistics. Proper drying is necessary to prevent microbial contamination and spoilage. Farmers must invest in drying beds, climate-controlled storage, and careful quality control measures. The delicate nature of Cascara poses challenges in maintaining its integrity during transportation, especially over long distances from remote farms to export hubs. Additionally, there are more logistical challenges that include the high cost of container shipping, often intensified by fluctuating global shipping rates and inadequate transportation infrastructure in producing regions. Regarding regulations and compliance, the EFSA approval for Cascara infusions highlights its potential but also imposes significant documentation and

traceability requirements. Farms must ensure that their Cascara meets these standards and upcoming regulations like the EU's deforestation law. This will further necessitate sustainable land-use practices and comprehensive documentation, adding complexity but also promoting environmental conservation (European Union 2023).

4.10 Prototype Development

Our initial prototyping phase was a critical step in moving from concept to practical development of our CBB. Through a series of structured prototypes, we built and refined our product recipe. Each prototype was guided by specific hypotheses and adjusted based on internal feedback, survey responses, and systematic improvements. The Table in Appendix C provides an overview of the prototyping process by summarizing goals, hypotheses, key modifications, final recipes, results, learnings, improvements and pictures for each prototype (P1–P4). The following sections refers, but also expands on this table, detailing our prototyping progression and the insights gained with each iteration.

P1 - Entrepreneurial Bootcamp: Prototype 1 (P1) marked our first foundational recipe of our CBB and was evaluated at the NOVA entrepreneurial bootcamp. We hypothesized that a hot-brewed Cascara base combined with a natural sweetener and acidifier would deliver the refreshing and distinctive taste. We experimented with various natural sweeteners and acidifiers, testing them internally and finalized the recipe with agave syrup and lime. Initial feedback was positive regarding the drink's unique taste, but it lacked the expected refreshment due to a slight bitterness. We also identified the need for structured data for measuring taste and guiding recipe adjustments. Without a data-driven approach, achieving consistent progress would be challenging (See Appendix C, P1).

P2 - Internal Class Tasting: Informed by P1's learnings, P2 was designed to increase refreshment by adding carbonation and switching to a cold-brew method. Additionally, we

standardized ingredient ratios and implemented a tasting survey to collect measurable feedback. This version was tested in an internal class tasting with mentors and 33 survey respondents. The P2 recipe included cold-brewed Cascara, carbonated water, agave syrup, and lime. Survey feedback achieved an overall rating of 7.48 out of 10, indicating general satisfaction with the unique taste. However, feedback also highlighted a lack of intensity and insufficient carbonation. Respondents suggested that increasing sweetness could further enhance the flavor experience. These results guided further improvements in P3.

P3 - Prototyping Fund Final Showcase: Incorporating lessons from P2, P3 focused on increasing both intensity and carbonation. Additionally, we recognized the impact of drinking experience on taste perception. We aimed to enhance this aspect by serving the beverage in prototype glass bottles. P3 was presented at our first NOVA Prototyping Fund Final Showcase, where it was tested by attendees and evaluated through 60 survey responses. Our hypotheses were that boosting sweetness and carbonation would result in a more intense, refreshing flavor, and that glass bottles would elevate the overall drinking experience.

The final recipe retained cold-brewed Cascara, carbonated water, agave syrup, and lime, with increased levels of sweetness and carbonation. Survey results showed an overall taste rating of 7.82 out of 10, reflecting enhanced positive feedback on the overall taste. However, respondents noted a slightly watery impression, likely due to increased carbonated water usage, and suggested further potential for sweetness enhancement. Glass bottles were well-received, confirming their positive impact on the drinking experience. These insights indicated a need for further adjustments to intensify flavor without increasing dilution, leading to the experimental approach adopted in P4.

P4 - Internal Testing Sessions: Learnings from P3 showed that simply intensifying the recipe components did not achieve the desired flavor depth, with ongoing feedback on insufficient intensity. This realization motivated us to revisit the recipe's foundation. In P4, we adopted a

more structured approach, testing various sweeteners and adding secondary flavoring aromas to boost intensity and complexity. Internal blind tastings guided us to a refined recipe using cold-brewed Cascara, carbonated water, stevia, lime, and hibiscus (See Appendix C, P4). This approach improved both the intensity and complexity of the flavor profile.

The continuous development of our prototype, based on structured feedback, was crucial in significantly improving the recipe. However, through ongoing research and expert interviews, we recognized that focusing solely on incremental flavor adjustments was too narrow. The beverage of the future combines joy with functionality/health (Werner, personal communication, 2024). Ultimately, our product and hence the recipe must deliver on this dual mission. Achieving this requires a more structured approach to recipe development, supported by robust data collection. At the same time, broader experimentation with additional functional ingredients is essential to find the right balance between taste and health benefits. This balance needs to be met to ensure alignment with consumer preferences, market development and our brand values. Further understanding and development of our CBB will be elaborated upon in chapter 7.

5 Overview of the Impact Business Model Canvas

As a foundational framework, the Impact Business Model Canvas (IBMC) synthesizes our collective research and provides us with a bird's-eye view of what we have achieved so far (See Figure 17). It provides a structured representation of how various elements of our business model interconnect to support our two-sided value proposition: empowering coffee farmers by transforming Cascara into a valuable commodity and offering consumers a sustainable, health-conscious beverage.

Problem Statement The traditional coffee value chain overlooks Cascara, treating it as waste, which results in missed opportunities for economic, social, and environmental impact.				
Mission Statement We promise to create a community, where everybody wins.				
Key Partners 1. Coffee Farmers & Cooperatives 2. Importers & Exporters 3. Prototyping Labs 4. Beverage Producers (Bottlers) 5. Logistics Providers 6. Retailers 7. Customers	Key Activities 1. Build Sourcing Partnerships 2. Develop the Product 3. Build a Brand 4. Go-to-Market 5. Secure Financial Viability Key Resources 1. Raw Material Cascara 2. Recipe & Dev. Expertise 3. Partnerships with Coffee farmers 4. Brand & Community	Value Proposition <i>"We transform Cascara, the often-overlooked coffee cherry, into a healthy and energizing beverage empowering traditional coffee farmers financially, embracing a circular economy approach by minimizing organic waste."</i>	Stakeholder Relationships 1. Inner System: Keep satisfied 2. Regional System: Manage closely 3. Outer System: Keep informed Channels 1. On-trade / Off-trade 2. E-commerce 3. Events / Fairs	Stakeholder Segments 1. Inner System 2. Regional System 3. Outer System
Cost Structure 1. Non-financial Costs 2. Financial Costs: CapEx & OpEx			Revenue Streams 1. Bottle Sales	
Intended Impact 1. SDG 8: Promoting sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all. 2. SDG 12: Ensuring sustainable consumption and production patterns. 3. SDG 17: Strengthening the means of implementation and revitalizing the global partnership for sustainable development.				

Figure 17: Overview of the Impact Business Model Canvas

To deliver the value proposition in a real-world context, it is crucial to identify and prioritize the key activities within the IBMC (Cuofano 2024; Innovation Within 2024). A deep understanding of these activities will enable the transition from the theoretical foundation to actionable and practical tasks. Accordingly, the individual *Field Labs* will focus on the following defined key activities:

Build Sourcing Partnerships: As the first critical first step in our value chain, sourcing lays the groundwork for everything that comes after. In the beverage industry, strategic sourcing decisions are particularly critical as they influence product quality, supply chain sustainability, and the ability to meet consumer expectations for ethically produced goods (McKinsey and Company 2023). This pivotal decision on a sourcing model and the origin of our Cascara directly impacts our capacity to achieve both commercial viability and mission-driven objectives. Through a detailed exploration of Cascara processing and a comprehensive evaluation of sourcing models, we aim to identify an approach that maximizes ecological and social impact while ensuring operational feasibility.

Develop the Product: Product Development marks the critical transition from our concept to a real-world product. This requires a foundational understanding of non-alcoholic beverage development. Building on this knowledge, this individual part aims to transform our raw Cascara into a replicable beverage. Through expert-guided, iterative recipe refinements and data-driven consumer tastings of our kitchen prototype, this chapter examines this process. This detailed exploration not only refines the product but also ensures it aligns with consumer expectations. Ultimately, it guides the way to an operationally feasible and scalable product.

Build a Brand: While the product embodies our functional value, the brand is essential in conveying our purpose and connecting emotionally with consumers. This field lab focuses on translating our internal identity - shaped by shared values, purpose, and vision - into a tangible branding and design strategy. Guided by expert insights and iterative testing, it examines the process of designing a brand that reflects who we are while appealing to our target group. This work lays the foundation for a consistent and impactful brand presence.

Go-to-Market: The development of a GTM strategy is important for ensuring the successful market entry of our product, particularly in a competitive and trend-driven landscape such as the beverage market. Early adopters, as seen as trendsetters, play a critical role in fostering organic growth by influencing broader consumer behaviors. This chapter addresses how to precisely identify early adopters and locate and engage these trendsetting individuals. By focusing on a hyperlocal approach, this field lab examines how specific sales channels and marketing activities can catalyze brand awareness.

Secure Financial Viability: Finally, securing the financial viability of the business is essential to ensuring long-term success. For early-stage startups, the lack of historical data and high uncertainty require detailed financial forecasting to understand potential financial commitments. This involves analyzing the costs of strategic decisions to clarify the cost structure and evaluating revenue potential to estimate growth opportunities. By integrating cost

and revenue insights into a financial model, this individual field lab aims to identify key financial performance indicators, determine funding needs and assess whether the business is financially viable.

These activities not only reflect our strategic priorities but also reveal knowledge gaps that we address individually in this work project. Each team member's focus area is linked to the broader goals outlined in the IBMC, ensuring that our efforts remain interconnected while addressing unique challenges. This structure enables us to contribute specialized insights that enhance the overall feasibility and viability of our business model.

All in all, the IBMC not only acts as a strategic framework but also as a bridge between our collaborative efforts and the targeted research needed to operationalize our venture. The next chapters will dive into each of the discussed components, exploring their potential and addressing the knowledge gaps we need to fill to ensure practical progress.

Part II: Individual Parts

6 Individual Part: Product Development Strategy (Lucas Obermeier)

6.1 Introduction

Every product journey begins somewhere, and for us, it was in the kitchen. Here, we brought our MVP to life and refined it to its initial potential. However, we soon realized that our capabilities in the kitchen were limited. Developing a non-alcoholic beverage (NAB) like our Cascara-based beverage (CBB) involves far more than crafting a great taste. Our beverage must balance sensory appeal, functional benefits, and operational feasibility while meeting all regulatory and consumer expectations. This requires not only professional expertise but also a deep understanding of how to transition from our prototype to a scalable, market-ready product. To bridge this gap, I first needed to understand how an NAB is professionally developed. This raised essential questions: What are the fundamental components of an industrial beverage recipe and its production? How can we then transform our raw Cascara into a finished, replicable beverage that resonates with our target group? And finally, how can operational feasibility and scalability be integrated into the recipe development process?

By collaborating with industry experts, conducting interviews and user tastings, I built the foundational knowledge to answer these questions. This process revealed two core areas of focus: *recipe development* and its integration with *beverage production*.

This part of the work project presents the theoretical knowledge gained and applies it to these two focus areas, marked as Knowledge Gaps (KG). KG1 focuses on professional prototyping for recipe refinement and iterative testing with our target group. KG2 addresses production challenges, and the strategic decisions required to ensure scalability and feasibility.

Together, these insights offer practical implications and provide a roadmap for transitioning from concept to a market-ready product.

6.2 Theoretical Framework: Development of a Non-Alcoholic Beverage

Figure 18 shows the *Beverage Development Framework* (BDF) derived from expert interviews and literature (Fuller 2004; Steen and Ashurst 2006; Südzucker 2012). It provides a practical overview and the foundational understanding of the process for developing a NAB.

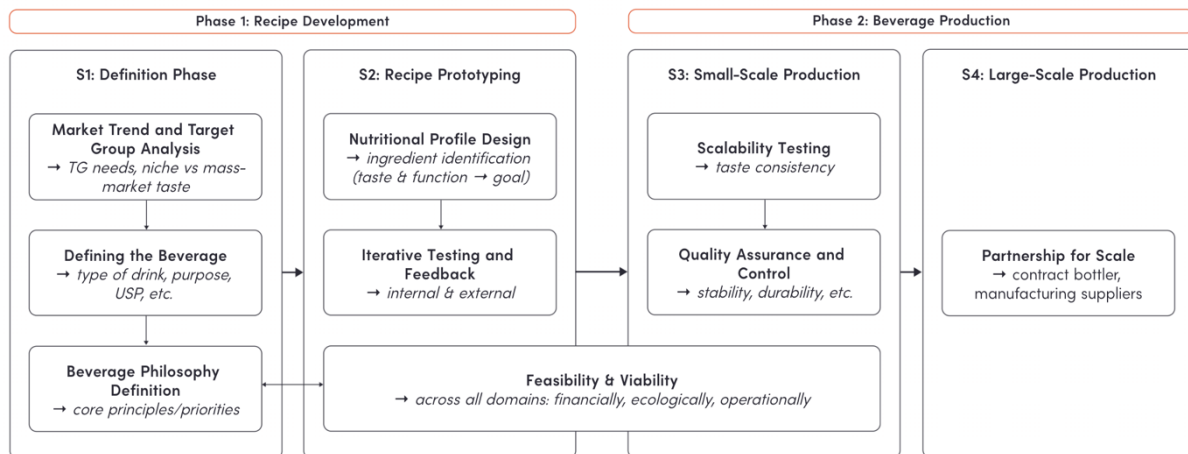


Figure 18: Non-Alcoholic Beverage Development Framework

The NAB development process can be divided into two major phases: *Recipe Development* and *Beverage Production*, each with two major steps (S1-S4).

Definition Phase (S1): The Definition Phase establishes the conceptual foundation of the Recipe Development phase. Here, critical decisions are made, that shape the product's market positioning and align its development with consumer expectations and brand identity. The process begins with a *Market Trend and Target Group Analysis*. This analysis helps answer key questions, such as whether the beverage should appeal to a broad audience with mass-market flavors or cater to a more niche consumer base with specialized preferences. Next, the *beverage definition* determines the fundamental attributes of the product. This includes its exact purpose and unique selling points. Finally, the *Beverage Philosophy Definition* sets the guiding principles for product development decisions. In the context of beverage development, these guiding principles refer to the fundamental ingredient choices and production decisions. For instance, they determine whether one uses only organic or as well artificial ingredients (See Chapter 7.4.1). This principle definition is crucial for two reasons: first, the possibilities for

designing a beverage are vast. These principles serve as valuable constraints and directional tools. Second, these product development decisions can have a significant impact on both the product cost structure and the production process. Hence these principles are essential for aligning the product goals with operational feasibility. (Jentsch, personal communication, 2024)

Recipe Prototyping (S2): In the Prototyping Phase, the focus shifts from conceptualization to experimentation and refinement. This stage begins with the *Nutritional Profile Design*, where possible ingredients are selected to meet the beverage's functional and sensory goals. Whether the aim is to create a low-calorie drink, a nutrient-enriched option, or a flavor-driven experience, the ingredients are carefully chosen to achieve these objectives. Next, *Iterative Testing and Feedback* is conducted to refine the prototype. To gradually improve the beverage internal testing by the development team and external feedback from target consumers or experts are used. The result is a validated recipe, ready for the first step of scalability. This marks the transition to the production phase. (Kollmannsberger, personal communication, 2024)

From the start of development, and particularly in this phase, the *feasibility and viability* of the beverage require close attention. Recipe development and production are highly interdependent. Certain ingredients or processes may be simple to execute during prototyping but become impractical at larger scales. This could occur because manufacturing facilities are unable to support specific production steps or because only a limited number of partners can accommodate the requirements. Additionally, some production steps that are cost-effective during prototyping can become significantly more expensive when scaled. (Jentsch, personal communication, 2024)

Small-Scale Production (S3): This phase translates the validated recipe into a reproducible production process on a smaller scale. *Scalability Testing* ensures that the flavor, texture, and sensory profile remain consistent when moving from lab prototypes to larger batches. Issues

like flavor dilution or ingredient interactions are addressed. *Quality Assurance and Control* follows to verify safety and shelf-life stability, with regular testing to resolve discrepancies. (Kollmannsberger, personal communication, 2024)

Large-Scale Production (S4): This final step transitions the beverage from small-scale batches to full-scale manufacturing. This stage is critical for achieving market-ready volumes while maintaining consistency and quality. For startups without access to in-house production facilities, the primary focus is on establishing *Partnerships for Scale*. Collaborations with contract manufacturers (bottlers) ensure the production infrastructure can handle large volumes while meeting all technical and quality requirements. (Kollmannsberger, personal communication, 2024)

6.2.1 Components of a Non-Alcoholic Beverage Recipe

To further understand the recipe development phase, it is first essential to explain what a NAB is made of.

In general, a NAB consists of a *base mix* that includes three main components: a flavoring, a sweetening, and an acidic component. Additionally, a functional ingredient may be included to enhance the product (Firnhaber 1991). This base mix is combined with processed water to create the final beverage (See Chapter 7.2.2).

Sweeteners provide the required sweetness and are classified as caloric or calorie-reduced/-free. Caloric sweeteners, such as sucrose, glucose, and fructose, deliver energy. In contrast, calorie-reduced options like steviolglycosides or xylitol cater to health-conscious consumers (Rosenplenter, von Rymon Lipinski and Nöhle 2007). Sweeteners are measured based on their relative sweetness compared to sucrose, which serves as the standard reference (Kollmannsberger, personal communication, 2024).

Edible acids play a critical role in balancing the sweetness-to-acidity ratio and ensuring microbiological stability by lowering the pH below 4.5, a standard for NABs (Südzucker 2012). Common acids include citric acid and malic acid, which provide both functional and sensory benefits.

Flavoring components (Aromas) define the beverage's primary taste profile. These include a *base aroma*, such as the Cascara-tea-infusion in our case, and *secondary flavor compounds*. Secondary flavors can add complexity, enhance the sensory experience, or serve a functional purpose. (Ziegler 2007)

Functional ingredients, such as vitamins or minerals, improve the drink's appeal or serve a technical function. For example, vitamin C (ascorbic acid) may be added to enhance shelf-life naturally by acting as a preservative (Petchmunee, personal communication, 2024).

This structured combination of components ensures that the beverage achieves a balance of flavor, functionality, and stability while meeting regulatory industry standards.

6.2.2 Beverage Production

Figure 19 shows a simplified version of a NAB production line. It highlights the essential steps universally applied in NAB manufacturing, regardless of specific NAB subtypes or ingredients (Kollmannsberger, personal communication, 2024; Südzucker 2012). Additional steps and related strategically important decisions are explained in chapter 7.5.

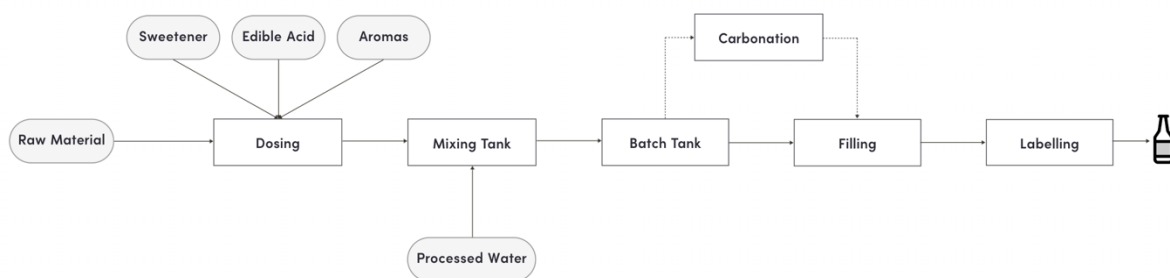


Figure 19: Simplified Beverage Production Process

The process begins with the raw material, which refers to the base aroma (See Chapter 7.2.1). Along with the raw material, the additional components such as sweeteners, edible acids, and aromas (secondary flavoring and functional compounds) are precisely dosed to create the base mix. These ingredients are then transferred to a mixing tank, where they are blended with processed water to achieve a uniform and consistent mixture. The blended liquid moves to a batch tank, serving as a holding stage for quality control and consistency checks. For beverages requiring carbonation, the product is sent to a carbonation unit, where carbon dioxide is added. The final product is then portioned into bottles or other packaging formats at the filling station. Finally, the packaged products are labeled, ensuring compliance with declaration standards.

6.3 Structure and Methodology

Figure 20 serves as a general overview of my accomplished steps during our work project. It shows the structure of my individual *Field Lab* process and the methodologies I used to further develop our product. This process was guided by the BDF (See Figure 18). Derived from this framework, two key focus areas emerged, identified as KGs.

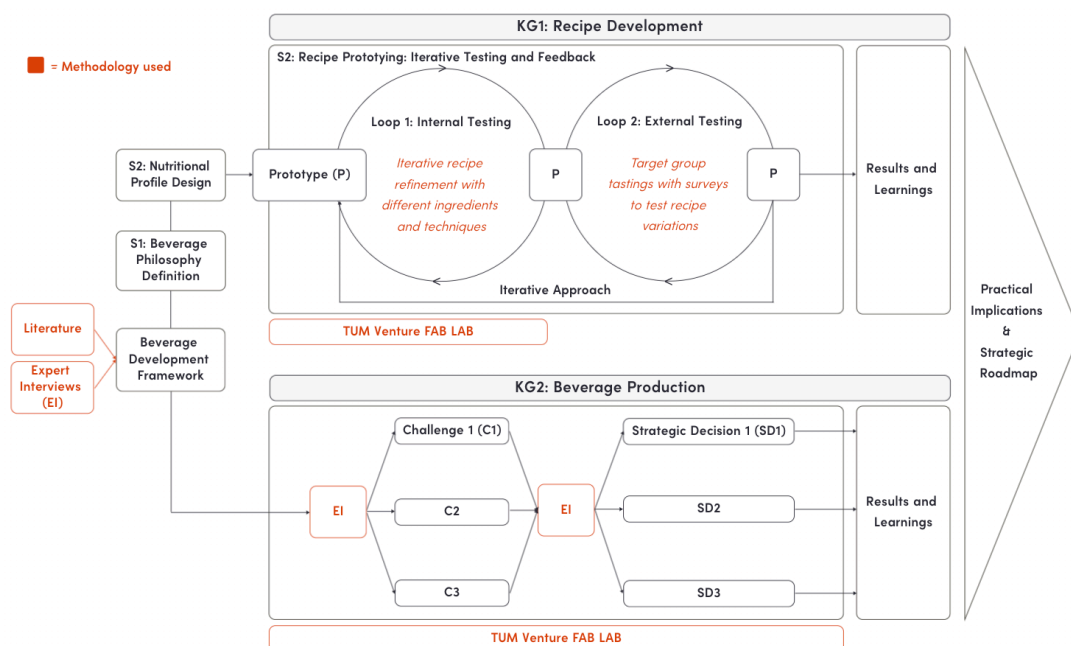


Figure 20: Overview of Individual Field Lab Process and Methodologies used

Recipe Development (KG1): I first aimed at finalizing the Definition Phase (S1) of the BDF (See Figure 18). Then, to address KG1, I mainly focused on refining our prototype through a more structured, data-driven approach. The goal was to enhance the recipe with technical expertise and evidence-based feedback. To approach this, I collaborated with the *TUM Venture FAB LAB*. This incubator from Technical University Munich (TUM) provided me access to their prototyping kitchen and technical guidance from experienced beverage technologists (See Appendix M). The prototype development process followed an iterative approach. Recipe variations were tested internally in the lab and refined based on sensory evaluations and ingredient adjustments. The refined prototypes were evaluated by target group participants through surveys, gathering quantitative and qualitative feedback to guide further adjustments.

Beverage Production (KG2): KG2 emerged as challenges related to the scalability and technical feasibility of producing our CBB became evident, based on our existing prototype production. These challenges were identified through expert interviews with beverage technologists and practitioners (See Appendix N). To address these, the experts provided insights into strategic decisions required for production, such as raw material processing, production line optimization, and shelf-life considerations.

Overall, this individual *Field Lab* provided valuable insights and learnings from both KGs. The results allowed me to derive concrete practical implications, which serve as the foundation for our strategic roadmap in the context of product development.

6.4 Recipe Development (KG1)

6.4.1 Beverage Definition (S1)

We already defined the exact market segment, our target group, and our beverage (See Chapter 4.5). Nevertheless, based on these definitions and additional survey results, two key insights emerged, guiding the product's development and objectives:

1. Our beverage does not need to cater entirely to mass-market taste, allowing for a slightly more niche flavor profile (Werner, personal communication, 2024).
2. For our target group, functionality and health benefits are nearly as important as taste (See Appendix O).

Building on this, four guiding principles have been established for our beverage philosophy:

1. Natural vs. Artificial Ingredients: We aim to avoid artificial ingredients, including synthetic preservatives. The focus remains on using natural components to align with consumer expectations for a clean and health-conscious product.

2. Organic vs. Conventional Ingredients: This principle requires nuanced consideration. Regarding Cascara, obtaining organic certification is often unrealistic for small-scale coffee farmers, even when all conditions for certification are met. The added costs associated with certification can create significant barriers (Schwarz, personal communication, 2024). Consequently, while a full organic certification is not mandatory for our beverage, the Cascara used must meet all food safety and quality standards.

3. Caloric vs. Non-Caloric Sweeteners: We prioritize the use of non-caloric sweeteners to align with consumer demand for reduced-calorie beverages. This decision ensures the product remains appealing to our health-conscious target group.

4. Lean vs. Complex Recipe: We aim to achieve maximum taste and functionality with as few ingredients as possible. This ensures simplicity and aligns with our goal of creating net positive impact.

Prioritization of Product Development Decisions: Based on insights from our target group (See Appendix O), as well as the beverage's objective and guiding philosophy, we established the following prioritization for evaluating product development decisions: 1. Taste, 2. Functionality, 3. (Ecological) Impact.

These priorities ensure that all decisions are aligned with our internal preferences and those of our target group, while balancing functionality and sustainability considerations.

6.4.2 Recipe Prototyping (S2)

Step 1: Nutritional Profile Design

As a basis for ingredient selection to further test and refine our prototype, I focused on the aromatic flavor profile of Cascara (See Appendix P). Additionally, I considered Cascaras natural functionality, such as caffeine, antioxidants, and minerals (Esquivel and Jimenez 2012; Lestari et al. 2022). Aromatic ingredients were selected based on their taste match and functional benefits, ensuring they added value to the beverage. Following our prioritization, I excluded overly unconventional ingredients (See Appendix Q).

Step 2: Internal Testing – Lab Prototyping

The internal testing phase focused on iterative experiments with our kitchen prototype. Under the guidance of TUM beverage technologists, I systematically tested all recipe components to refine both the sensory and functional properties of our prototype. In the following section the tests domains, their objectives, and the main learnings are presented. A detailed overview of additional learnings gained is provided in Appendix R.

The raw material, Cascara, was analyzed for sensory quality, extraction efficiency, and its optimal physical state. To determine the ideal Cascara-to-water ratio, I tested samples from different suppliers and origins, using research by Abduh et al. (2023) as a foundation. This study indicated that the phenolic content of Cascara is maximized at a water temperature of 77°C and an extraction time of 8 minutes, which I applied as constants in our tests. Shredded Cascara proved to be significantly more intense in flavor, allowing us to establish an optimal ratio of 60g of Cascara per liter of water, achieving an average extraction efficiency of 80%. (See Appendix S)

As the second base aroma, I experimented with different tea varieties. The goal was twofold: to balance the bitterness of Cascara and to further enhance the beverage's functionality with antioxidants and caffeine. I aimed to identify the most suitable tea based on sensory evaluations and then optimized the Cascara-to-tea ratio. Black tea emerged as the most suitable option at a ratio of 20% tea infusion to 80% Cascara infusion, which provided an optimally balanced sensory profile. (See Appendix T)

To address user feedback requesting greater flavor intensity, we conducted internal blind tests with a variety of natural aromatic compounds. These were selected to enhance the complexity of the flavor profile and the beverage's functionality. Among the tested options, blueberry emerged as the best-tasting addition alongside the existing hibiscus, followed by pomegranate and sour cherry. However, the results also highlighted that without professional sensory training, subtle differences in co-aromas are difficult to perceive and evaluate. (See Appendix U)

In my sweetener tests, I first established the sweetness intensity using sucrose as the standard reference (Kollmannsberger, personal communication, 2024). This approach enabled me to quantify the equivalent sweetness levels of non-caloric sugar alternatives. I then evaluated these alternatives for their sensory impact on the beverage. The optimal sweetening power was determined to be 3g sucrose per 100ml of Cascara-black-tea-extract. Among non-caloric options, stevioglycoside emerged as the best sensory fit. Vanillin proved effective in compensating for the reduced texture (fullness) caused by the lower water solubility of stevia (Südzucker 2012, p. 45). (See Appendix V)

For the edible acid component, I conducted tests using citric acid. Sensory analysis was performed to determine the optimal acid quantity for a balanced flavor profile. Additionally, pH measurements were taken to establish a stability reference for the beverage. The results showed that citric acid is best balanced at a dosage of 1g per liter of beverage, achieving a pH

value of 4.29, which is below the critical threshold of 4.5 for microbiological stability. (See Appendix W)

Step 3: External Testing - User Tastings

We conducted several user tastings to validate our prototype and recipe adaptations with potential customers. These tastings included qualitative feedback through open discussions and structured surveys to gather data-driven insights. Participants were asked to rate the beverage overall as well as evaluate its key sensory attributes: sweetness, sourness, bitterness, intensity, and carbonation (See Appendix X). The results provided valuable direction for refining the prototype. In addition to smaller qualitative tastings, we conducted three larger user tests: 1. Nova Surf Festival (N = 33 survey participants); 2. KPMG User Testing (N = 20); 3. Prototyping Fund Final Showcase (N = 36). Appendix Y presents a short overview about these events.

The first key insight was that taste perceptions are highly individual. Additionally, users often lack the sensory expertise to provide high-quality feedback on individual flavor components (Jentsch, personal communication, 2024). Therefore, we focused on the most valuable aspects: *overall taste* and *beverage intensity*.

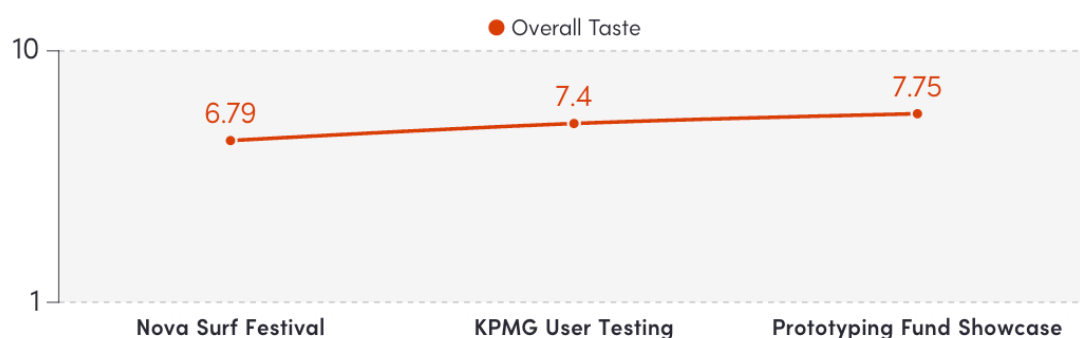


Figure 21: Survey Analysis: Overall Taste

Overall Taste: Figure 21 presents the overall taste ratings, rated at a Likert-scale from 1 to 10.

The results show steady improvement in consumer satisfaction as recipe adjustments were

implemented: 6.74 at the Nova Surf Festival, 7.40 at the KPMG User Testing, and 7.75 at the Prototyping Fund Showcase. This trend validates the effectiveness of our recipe refinements. Out of internal lab testing, a second prototype with a different flavor profile emerged. It was rated at 7.28, not validating our assumption that this would be a superior option for our first product. (See Appendix Z)

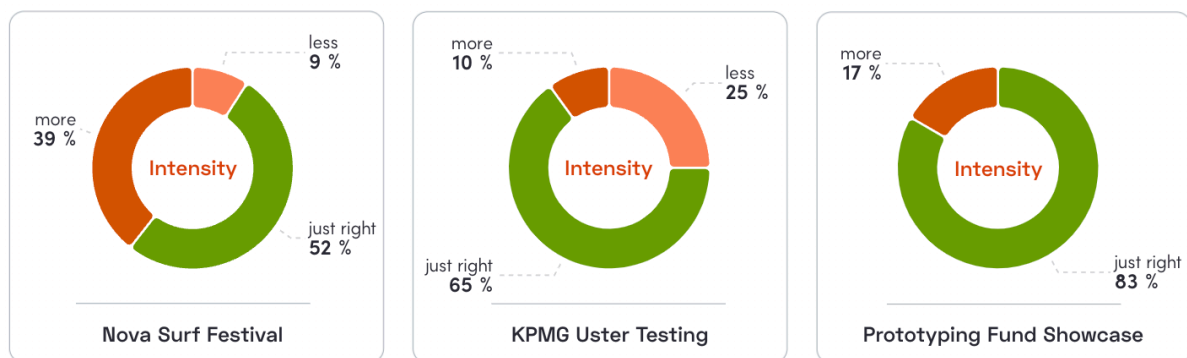


Figure 22: Survey Analysis: Beverage Intensity

Beverage Intensity: Figure 22 illustrates consumer feedback on the beverage's intensity, which was a major focus during the internal prototyping process. Initially, intensity was a point of critique, with many participants suggesting it was too weak. My adjustments of the Cascara-to-water ratio and the adoption of shredded Cascara have shown positive effects. By the Prototyping Fund Showcase, 83.3% of participants rated the intensity as “just right”, highlighting the success of these adaptations. (See Appendix AA)

6.5 Beverage Production (KG2) - Challenges and Strategic Decisions

During the testing of our prototype in the Venture LAB, the TUM beverage technologists identified several problematic areas within our production line. They observed potentially unnecessary complexity and cost-intensive steps that could hinder scalability. Figure 23 illustrates our refined, detailed production line, highlighting the main challenges and the strategic decisions required to address them.

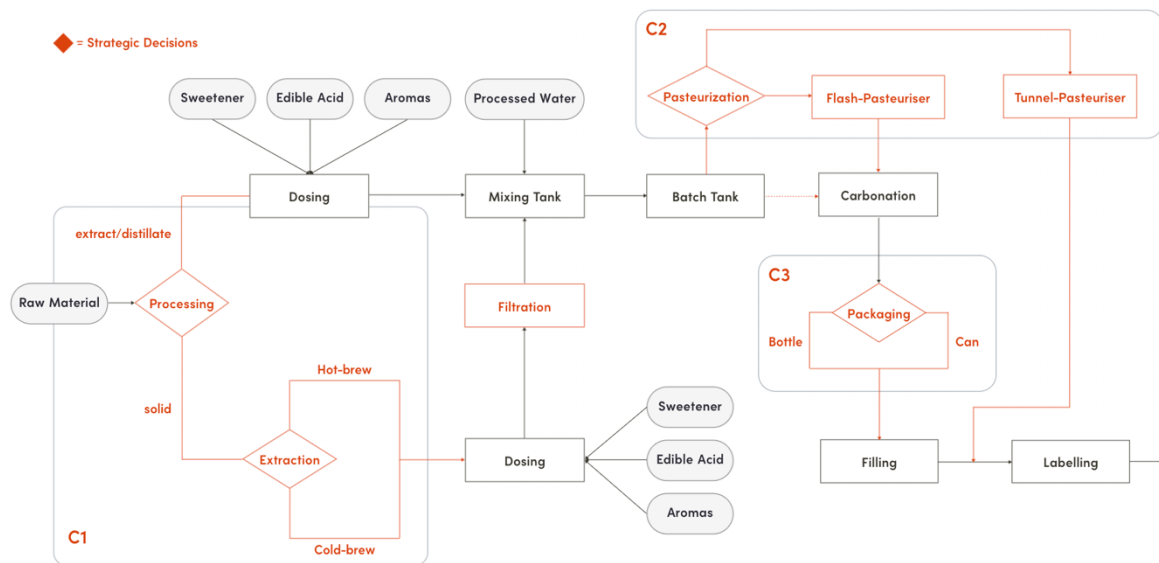


Figure 23: Applied Beverage Production Process with Strategic Decisions

Raw Material- Processing & Extraction (C1): The current production process relies on a solid extraction hot-brew method for raw material processing. While effective for prototyping, this method introduces two major challenges for scalability:

- **Filtration Requirements:** Solid extraction requires additional steps to filter out residual solids after brewing. This adds both operational complexity and cost, as filtration units are essential to ensure a clean and uniform product. (Petchmune, personal communication, 2024)
- **Energy-Intensive Warm Production:** The hot-brew extraction method results in a warm production line, which, at a larger scale, is highly energy-intensive. This significantly increases production costs compared to a cold production process. (Petchmune, personal communication, 2024)

To address these issues, two alternatives were explored: using a dissolvable extract or a water-based distillate. Both options eliminate the need for filtration and enable a more energy-efficient cold production process. However, regulatory constraints narrowed the choices. According to EFSA guidelines, dissolvable extracts are non-compliant with Cascara's current regulatory framework (See Chapter 2.3). This makes the water-based distillate the most viable option. We

have already begun to evaluate samples of such distillates (See Appendix AB). In conclusion, transitioning to a water-based distillate simplifies production and reduces its energy consumption. This decision addresses the critical challenges of raw material processing and positions the production line for efficient scaling.

Pasteurization (C2): As part of our guideline to avoid non-natural additives, we excluded the use of chemical preservatives in our beverage. However, ensuring the product's shelf life remains essential. This can be achieved through pasteurization. This heat treatment process is designed to reduce microbial activity and extend the stability of beverages (Schumann 2002). Kollmansberger (personal communication, 2024) advised us that two main types of pasteurization are applicable for our product: *flash pasteurization* and *tunnel pasteurization*. Flash Pasteurization, also known as high-temperature short-time (HTST) pasteurization, involves heating the beverage before filling to a high temperature (approximately 72–95°C) for a very short duration, typically 15–30 seconds, before quickly cooling it (Lewis and Heppel 2000). Tunnel Pasteurization involves heating the beverage after it has been filled and sealed in its final packaging. The product is gradually heated to the desired pasteurization temperature (carbonated NAB: min 60°C) and then cooled in a series of controlled zones within the tunnel (Schneidermann 2012). Both options have distinct advantages and disadvantages (See Appendix AC). At this stage of product development, we cannot yet determine which pasteurization method is optimal for our case. Both methods have specific implications for the flavor profile and quality of the final beverage. This requires evaluation and testing at the small-scale production phase (See Figure 18) to inform a final decision.

Packaging(C3): This decision can be evaluated from various perspectives, particularly financial, marketing, and sustainability considerations. However, this section focuses exclusively on the product-specific requirements. The contained polyphenols in our CBB are

highly sensitive to light and oxygen exposure. Hence, the choice of packaging comes down to *cans* or *brown glass bottles* (Kollmannsberger, personal communication, 2024). Both meet key product-specific needs. Cans provide complete protection as they are airtight and fully lightproof. This makes them the best option for preserving quality. However, brown glass bottles also offer light protection and perform nearly as well in maintaining product stability, making them a strong alternative to cans. (Petchmune, personal communication, 2024)

6.6 Practical Implications and Strategic Roadmap

While significant progress was made during the Field Lab, the primary practical implication from all results and learnings is clear: we cannot develop the beverage entirely in-house. The expertise required at key stages is extensive. Building this knowledge internally would not only be costly but also risky, potentially leading to critical missteps early in the process. Recipe development and production are tightly interlinked. Strategic decisions must account for scalability and manufacturing feasibility from the start (See Figure 18). This insight highlights the necessity of outsourcing at some point in the development process. Through interviews with other beverage company owners two scenarios have emerged, each with distinct trade-offs:

Scenario A (Early Outsourcing): Recipe development would be outsourced to a professional freelance beverage developer. He would deliver a final product that meets our specifications and all regulatory requirements. The intellectual property (IP) of the recipe would then be purchased. This ensures way faster market readiness at scale and frees internal resources. On the other hand, it demands upfront costs, limits prototyping possibilities and our influence on the development process.

Scenario B (Late Outsourcing): Development would continue in collaboration with the TUM Venture FAB LAB, closely guided by beverage technologists with production expertise. We would independently manage the NAB development process up to the completion of S3, the

small-scale production phase (See Figure 18). By investing in a small production line with a capacity of 100–1,000 liters, we could test the product continuously with our target group and even begin selling small test batches. This method allows for close control over the product development process, while also fostering internal expertise. However, it significantly extends the timeline, delaying large-scale production and market entry. Additionally, it ties up substantial internal resources, which could otherwise be allocated to other business areas.

This scenario-decision is a critical strategic milestone that cannot be made only from a product development perspective. We are currently exploring both options and have begun discussions with potential partners for both scenarios. Ultimately, the decision must be based on careful analysis of the facts. Nevertheless, it will reflect whether we prioritize rapid scalability as entrepreneurs or craftsmanship as connoisseurs.

Part III: Group Part

7 Discussion

Now that we have presented our deep dives into the key activities of our CBB business, it is time to take a step back and adopt a bird's-eye perspective. This broader view allows us to evaluate how our vision is translated into practice. The core premise of this work project was to explore the potential of transforming Cascara from a previously underutilized by-product into a valuable and sustainable ingredient for beverages. All while laying the groundwork for an impactful and profitable business. In general, the findings from our market research, expert interviews, the field trip to Central America, and consumer tastings strongly indicate that both feasibility and market potential are fundamentally present. However, as we transition from concept to implementation, we must match our ambitious impact vision with the practical constraints of real-world execution.

Through our value chain analysis, we gained a critical insight: achieving the highest levels of transparency, control, and measurable impact would ideally require direct management of every part of our value chain: from coffee farmers to the end consumer. However, the detailed examination of the value chain, through our individual field labs, has revealed that achieving such a level of control is far more complex than initially anticipated. One clear example of this challenge lies in product development. While our team brings strong expertise in Sales, Marketing, Branding, and Finance, we lack the specific technical skills required for sourcing and beverage development. The absence of a professional beverage technologist has revealed significant barriers in our ability to develop a high-quality product entirely in-house. Attempting to execute product development without addressing this skills gap would lead to inefficiencies and jeopardize the overall feasibility of our business model. This highlights the

need to carefully assess outsourcing, where external expertise can complement our internal capabilities.

To ensure that our outsourcing decisions align with our core values, we must focus on a methodology rooted in ethical alignment, transparency, and measurable impact. This involves prioritizing partners whose practices are consistent with our mission of ecological and social sustainability. Rather than creating a rigid decision framework, we rely on a values-driven approach: selecting partners who demonstrate a commitment to fair labor practices, environmental responsibility, and the ability to track and measure the impact of their operations. By fostering open communication and mutual accountability, we can integrate external expertise into our value chain without compromising our social mission. A practical example of this approach is our adoption of a hybrid sourcing model. This model balances operational efficiency with impact orientation by partnering with intermediaries who share our values. These partnerships allow us to maintain transparency and control over key sourcing activities while leveraging the expertise and resources of trusted collaborators. Through this model, we demonstrate how outsourcing, when aligned with our mission, can enhance both scalability and impact without risking mission drift.

Despite these strengths, certain limitations remain. For example, while we aim to close the product lifecycle by reintegrating Cascara waste into a circular economy, this remains an area requiring further research. Concepts such as downcycling Cascara into biogas, fertilizers, or animal feed hold potential but lie outside the scope of this work. Future research will be necessary to evaluate these opportunities and establish a more robust circular economy framework for Cascara.

In conclusion, our journey started with a vision centered on creating both environmental impact – by upcycling Cascara – and social impact – by supporting coffee farmers through diversified income streams. However, the transition from this idealistic vision to practical implementation

unveiled significant challenges. Our individual analyses highlighted that achieving impact depends on market demand and financial viability. Without a stable foundation, no lasting impact can be created. This realization shifted the focus toward emphasizing consumer benefits, prioritizing health, fun, and enjoyment in product and brand development. However, by fostering close partnerships we believe that we can realize our company's promise: to create a community where everyone wins and where Cascara becomes a driver of positive ecological and social change.

8 Future Outlook: Growing with Purpose

While the journey so far has required pragmatic decisions, our idealistic vision remains at the core of our mission. We have demonstrated that our vision, bridging environmental and social impact, is achievable, but its full realization lies in future steps. Moving forward, we will expand our efforts to directly benefit coffee farmers, growing our impact incrementally and sustainably.

In the upcoming coffee harvest season, we plan to visit coffee-growing regions to gain a deeper understanding of the lives, challenges, and opportunities faced by farmers. Operationally, our immediate focus lies in finalizing product development and collaborating with a contract bottler to produce the first batch of our beverage using our own financial resources. Having a tangible product in hand will allow us to collect further, hands-on feedback, learning from insights, iterate, and refine our product. This process will help us build on the proof of concept and evaluate the feasibility of our venture under real-world conditions.

These practical steps align closely with the broader findings of this work project, which highlight the emergence of a new market category centered around Cascara and its potential to generate economic, social, and environmental impact. However, achieving this impact depends

on generating strong market demand. Only with such demand can large-scale sourcing become economically viable, enabling us to contribute meaningfully to the targeted SDGs.

Since the Cascara industry is still in its early stages, the current demand is not yet at scale. This presents a main challenge but also an opportunity for the future. By entering the market now, we have the chance to shape the path of this emerging industry. As value-driven pioneers, we aim to guide the industry with a strong focus on sustainability and impact, ensuring these principles remain at the forefront of its development. By positioning ourselves as a trusted leader, we can create the demand needed to unlock Cascara's full potential, both economically and socially. When people hear about the coffee cherry, we envision that their first thought will turn to our brand and our Cascara drink, setting the standard as the most recognized product in the Cascara market.

This commitment to thoughtful growth reflects our intention to become a *Zebra*, not a *Unicorn* (Rahardjo 2023). Rather than pursuing rapid, unsustainable growth, we aim to prioritize sustainability and community-building from the ground up, connecting coffee farmers to end consumers through shared values. This long-term approach is not a compromise but an opportunity to create lasting value, both socially and economically.

In summary, our entrepreneurial journey has revealed the ambiguity and complexity of creating an impact-driven venture. Balancing idealism and reality requires navigating difficult decisions while remaining true to the company's purpose and values. This challenge is both demanding and exciting, offering the potential to contribute positively to society. As the Cascara Collective, we see this as more than a business opportunity, it is a chance to redefine how entrepreneurship can align with purpose.

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List of Abbreviations

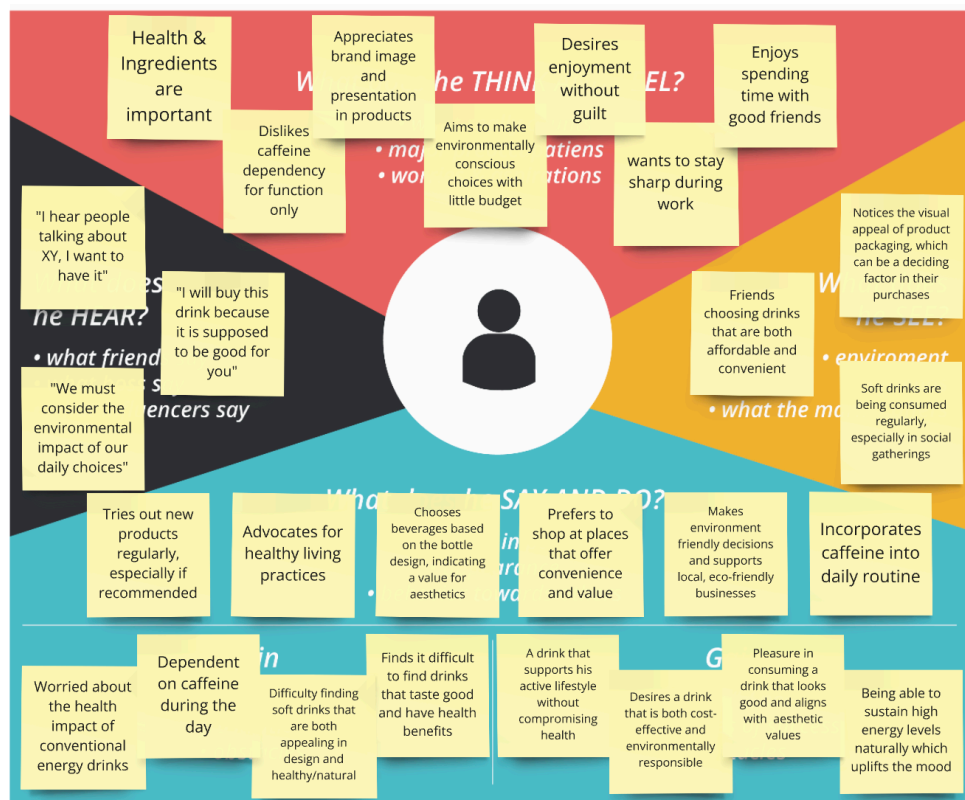
B2B	Business-to-Business
B2C	Business-to-Consumer
CAGR	Compound Annual Growth Rate
CBB	Cascara-based beverage
EFSA	European Food Safety Authority
GTM	Go-to-Market
IBMC	Impact Business Model Canvas
MB	Mood Board
MVBB	Minimum Viable Brand Book
NAB	Non Alcoholic Beverage
SAM	Serviceable Available Market
SDGs	Sustainable Development Goals
SOM	Serviceable Obtainable Market
TAM	Total Addressable Market
TUM	Technical University Munich
VP	Value Proposition
KG	Knowledge Gap
KPI	Key Performance Indicators
COGS	Cost of Goods Sold
OpEx	Operational Expenses
CapEx	Capital Expenses
IP	Intellectual Property
VC	Venture Capital
IPO	Initial Public Offering

Appendix

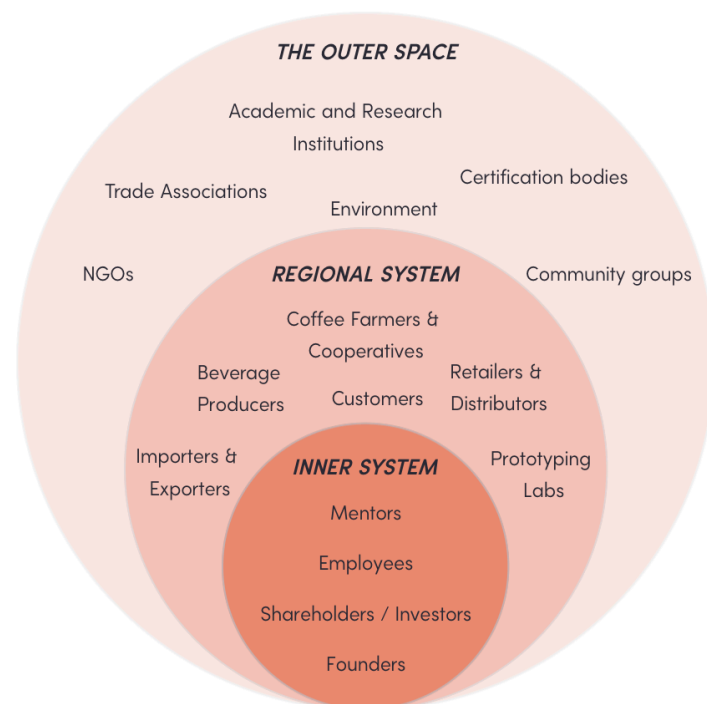
General Part:

Appendix A: Customer Exploration (upper) and Empathy Map (lower)

Who is our customer / user / stakeholder ? Be specific: for a person - age, origin, job, interests for a company - size, industry, purpose				What are his likes and dislikes ? Related to the general character of the person / stakeholder			
Germany, England & 18-30 years	mostly academic background	Students or young professionals with 2-5 years of work experience		Likes: healthy lifestyle, sports, being in nature, outdoors, mindfulness	Likes: time with friends, good food & drinks, music & party, caffeine & specialty coffee	Dislikes: industrialized consumption, getting bored, sugar	
Jobs to be done & challenges Functional / social / emotional / supporting needs in a specific situation e.g. I need fast transport / good reputation / security / help to... Quotes, that could be typical for this person				What we don't know Assumptions, black spots Why / when is something a challenge / a good experience...?			
Finding a healthy alternative for caffeinated drinks	Establishing a work-life balance	Caffeine is wanted for function or pleasure	Coffee caffeine rush is followed by a energy down	What's the caffeine effect of cascara (compared to coffee)?	What ingredients are perceived as healthy and delicious?	How healthy is Cascara for the body?	What are the specific dietary preferences and restrictions? Price sensitivity
Existing solutions Any kind of solution that could help to fulfill the needs				THIS WOULD BE GAME CHANGING! Empathize with your customer / user / stakeholder What would be the perfect solution, situation or experience?			
Coffee (Caffeine)	Mate & Energy drinks (Taurin & Guarana)	Green tea (Tein)	Soft Drinks	Natural Alternative for Caffeinated Beverages (Soft drinks & Energy Drinks)	High accessibility in sports clubs, bars, supermarkets etc	Caffeinated beverage with a better reputation than energy drinks or mate	Not being "dependent" on coffee anymore



Appendix B: Stakeholder Ecosystem



Appendix C: *Prototype Testing*

	P1		P2		P3		P4	
Goal	Develop a foundational recipe for a refreshing, organic, and healthy beverage using Cascara as the core ingredient		Create a more refreshing taste by incorporating carbonation and using a cold-brew method.		Enhance drink intensity through increased sweetness and carbonation, and improve the drinking experience with prototype glass bottles		Challenge and refine the foundational recipe by experimenting with new sweeteners and adding a secondary flavoring agent to enhance intensity	
Hypotheses	H1: A hot-brewed Cascara base with natural sweetener and acidifier will deliver a refreshing and unique taste experience	H1: Adding carbonation will enhance the refreshment quality of the beverage	H1: Cold-brewing Cascara will produce a smoother, less bitter flavor profile	H1: Increasing sweetness and carbonation will create a more intense and refreshing beverage	H1: Serving in glass bottles will enhance the drinking experience	H1: Adding a secondary flavoring agent will increase intensity without overpowering the original Cascara flavor.	H1: Using alternative sweeteners can achieve desired sweetness levels without compromising flavor	
		H2: Switched to a cold-brew method to reduce bitterness and create a smoother flavor profile	H2: Added carbonation to enhance the beverage's refreshment quality	H2: Increased the amount of agave syrup to boost sweetness, aiming to achieve a more intense flavor.	H2: Increased carbonation to further enhance refreshment and reduce perceived bitterness	H2: Introduced glass bottles to improve the drinking experience.	H2: Added and experimented with various secondary flavoring agents (selected hibiscus) to enhance intensity without overshadowing Cascara's natural flavor	H2: Tested multiple natural sweeteners (selected stevia) to achieve balanced sweetness
Key Modifications	N/A	N/A	KM1: Added carbonation to enhance the beverage's refreshment quality	KM1: Increased carbonation to further enhance refreshment and reduce perceived bitterness	KM1: Increased the amount of agave syrup to boost sweetness, aiming to achieve a more intense flavor.	KM1: Added and experimented with various secondary flavoring agents (selected hibiscus) to enhance intensity without overshadowing Cascara's natural flavor	KM1: Tested multiple natural sweeteners (selected stevia) to achieve balanced sweetness	
			KM2: Cold-brewed Cascara	KM2: Carbonated water (CO2)	KM2: Carbonated water (CO2)	KM2: Carbonated water (CO2)	KM2: Carbonated water (CO2)	KM2: Carbonated water (CO2)
Final Recipe	Base Ingredient (B1): Sweetener (S1): Acidifier (A1): Second Flavoring Agent (SFA1)	B1: Hot-brewed Cascara B1Z: Agave syrup S1: Lime juice A: N/A	B1: Cold-brewed Cascara B1Z: Carbonated water (CO2) S1: Agave syrup S1: Lime juice A: N/A	B1: Cold-brew Cascara B1Z: Carbonated water (CO2) S1: Increased agave syrup S1: Increased lime A: N/A	B1: Cold-brew Cascara B1Z: Carbonated water (CO2) S1: Increased agave syrup S1: Increased lime A: N/A	B1: Cold-brew Cascara B1Z: Carbonated water (CO2) S1: Stevia A: Lime SFA1: Hibiscus	B1: Cold-brew Cascara B1Z: Carbonated water (CO2) S1: Stevia A: Lime SFA1: Hibiscus	
	Learning 1 (L1):	Positive feedback on unique taste but lacked expected refreshment, slightly bitter.	L1: Overall taste was perceived as good and unique	L1: Sweetness was perceived as good with upward potential.	L1: Carbonation was improved but still left a slightly watery impression	L1: Improved intensity and complexity of flavor profile	L1: Improved intensity and complexity of flavor profile	
	Results / Learnings	L2: No structured data for measuring taste or building recipe	L2: Beverage lacked sufficient carbonation.	L2: Beverage lacked intensity, potentially due to insufficient sweetness.	L2: Carbonation was improved but still left a slightly watery impression	L2: Glass bottles received highly positive feedback for the drinking experience	L2: Identified the need for a more structured data-driven approach to ingredient selection	
			L3: 33 respondents rated the overall taste 7.82 out of 10	L3: 60 respondents rated the overall taste 7.48 out of 10	L3: Further improve intensity by challenging and expanding the foundational recipe despite positive taste feedback	L3: Continue using glass bottles to enhance the overall drinking experience	L3: Expand focus beyond taste to include functionally, ensuring alignment with the goal of creating a natural and healthy beverage	
Improvements	Improvement 1 (I1):	Add carbonation for lighter, more refreshing texture.	I1: Increase intensity by enhancing sweetness and carbonation	I1: Further improve intensity by challenging and expanding the foundational recipe despite positive taste feedback	I1: Continue using glass bottles to enhance the overall drinking experience	I1: Expand focus beyond taste to include functionally, ensuring alignment with the goal of creating a natural and healthy beverage	I1: Expand focus beyond taste to include functionally, ensuring alignment with the goal of creating a natural and healthy beverage	
	I2:	Use cold-brewed Cascara to reduce bitterness and enhance floral/fruity notes.	I2: Recognize that drinking experience significantly shapes taste perception	I2: Further improve intensity by challenging and expanding the foundational recipe despite positive taste feedback	I2: Continue using glass bottles to enhance the overall drinking experience	I2: Expand focus beyond taste to include functionally, ensuring alignment with the goal of creating a natural and healthy beverage	I2: Expand focus beyond taste to include functionally, ensuring alignment with the goal of creating a natural and healthy beverage	
	I3:	Implement survey usage to ground taste experience on data.	I3: Implement survey usage to ground taste experience on data.	I3: Implement survey usage to ground taste experience on data.	I3: Implement survey usage to ground taste experience on data.	I3: Implement survey usage to ground taste experience on data.	I3: Implement survey usage to ground taste experience on data.	

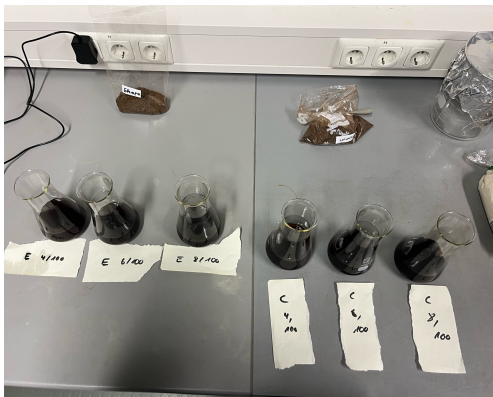


Appendix D: Interview List

Nr.	Interviewee	Company	Field of Expertise
1	R. Saltman	Nova SBE	Startup Mentor
2	N. Habib	Nova SBE	Entrepreneurship
3	S. Adler	Nova SBE	Startup Mentor
4	K. Schadwald	Cascaritas	Cascara Beverage Startup Founder
5	Dr. R. Nagel	ProGua e.V.	Coffee Non-profit Organization & Cooperative
6	Dr. R. Werner	TUM Venture Lab	Food, Agro & Biotech Startup Incubation
7	F. Peters	Biohack Spirit	Sales & Marketing
8	K. Stadelmeyer	ADM	Cascara Research
9	H. Kessler	TXE Extraction Services	Process Engineer
10	Dr. S. Schwarz	Coffee Consulate	Applied Coffee Science & Research
11	A. Schloesinger	HPC AG	Cascara Research
12	B. Rizvanovic	Madan Parque	Business Development
13	J. Casaca Lemos	JCLLTD, Quinta Flamingos	Design Strategy
14	S. Subramanian	OFI	Coffee Trader
15	D. Andrea	La Voz	Coffee Farm & Cooperative
16	M. Hernandez	La Azotea	Coffee Farm
17	T. Reher	Shangri-La	Coffee Farm & Cooperative
18	L. Edelmann	Finca Hamburgo	Coffee Farm & Cooperative
19	L. Clerkx	This Side Up Coffees	Coffee & Cascara Import
20	V. Montgomery	Martin et Karczinski	Visual Design & Strategy
21	F. Haas	Blossom Design	Visual Design & UX/UI Design
22	D. Albert	Monospace Design	Brand Identity Strategy
23	E. Ayaz	ATOLYE	Strategic Design Consultancy
24	I. Lampreia	Morais Leitao	Legal Consultancy
25	L. Kunzmann	Kara Limo	Cascara Beverage Startup Founder
26	S. Kollmannsberger	TUM Venture LAB	Beverage Technologist
27	R. Jentsch	TUM Venture LAB	Beverage Technologist
28	S. Petchmunee	TUM Venture LAB	Beverage Technologist
29	D. Ullrich	Kattlenburg	Sales & Marketing
30	L. Huber	Mono Tea	Sales & Marketing
31	J. Groseker	J's Lemonade	Sales & Marketing
32	J. Balumena	JM Blickwinkel	Sales & Marketing
33	C. Iwanski	ROY Kombucha	Sales & Marketing
34	B. Bohm	Cans	Sales & Marketing
35	Anonymous	Anonymous	Head of Marketing
36	Manuel Fischer	Beverage Boutique	Recipe Development
37	Julius Widmayer	Panda Nutrition GmbH	Beverage StartUp
38	Daniel Maßing	EUROGLAS Verpackungsgesellschaft m.b.H.	Bottle Manufacturer
39	Thomas Humann	Friedrich Lutvogl GmbH & Co. KG	Bottling Services
40	Holger Steiner	Lagenser Fruchtsäfte Koch Getränke GmbH	Bottling Services
41	Christian Langer	HALBSTARK Langemann & Neifer GbR	Specialty Coffee

Individual Field Lab – Product Development Strategy (Lucas Obermeier)

Appendix M: TUM Venture Lab Prototyping Kitchen



Appendix N: Overview of TUM Experts

Name	Company	Role	Field of Expertise
R. Werner	TUM Venture FAB LAB	Managing Director	Brewing and beverage technologist, FAB Startup Incubation
S. Kollmannsberger	TUM Food and Agro Center for Innovation and Technology (FACIT)	Maker Space Manager	Brewing and beverage technologist; Beverage Recipe Development; Beverage Production
R. Jentsch	TUM Venture FAB LAB, RJ Kombucha	Beverage Startup Founder	Brewing and beverage technologist; Recipe Development
S. Petchmunee	TUM Venture FAB LAB / Sahni Beer	Beverage Startup Founder	Brewing and beverage technologist
P. Schiwiek	TUM Food and Agro Center for Innovation and Technology (FACIT)	LAB Manager	Beverage Microbiology

Appendix O: Survey Results – Prioritization and Influence of Buying Decision

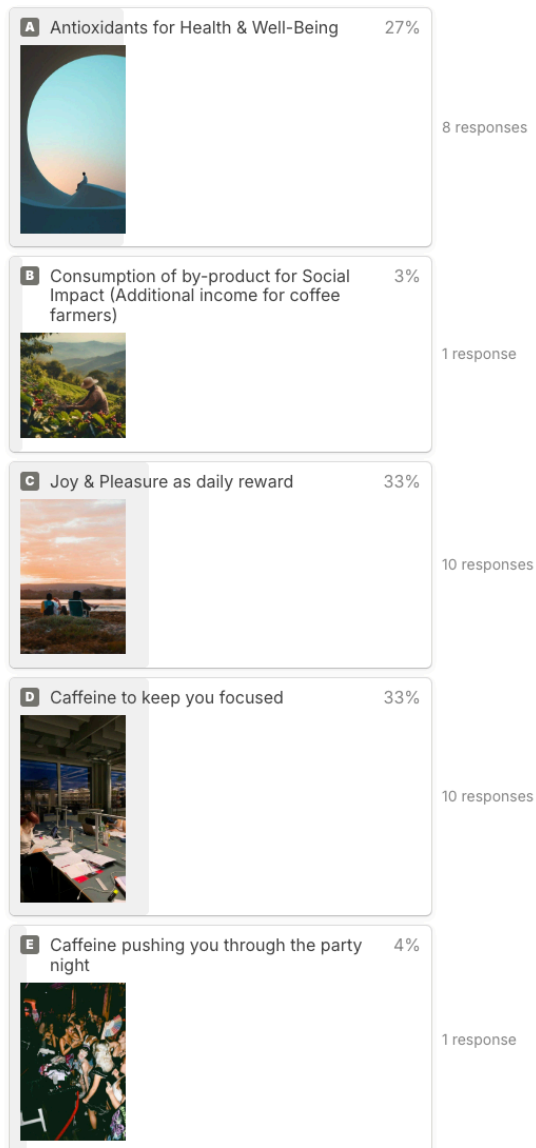
What do you value the most when buying a soft drink?

60 out of 60 people answered this question

#1	Taste	#2.2 average
#2	Energy-Boost (Caffeine)	#2.83 average
#3	Health	#2.97 average
#4	Sustainability	#3.87 average
#5	Design	#4.25 average
#6	Brand	#4.88 average

Our drink offers various benefits: Which aspect is most important to you?

30 responses



Appendix P: *Flavor Profile of Cascara*

Groups	Subgroups	Aroma Examples (Orthonasal)
Fruit	Citrus	Bergamot, Grapefruit, Kumquat, Lime, Mandarin, Orange, Lemon
	Berries	Blueberry, Blackberry, Strawberry, Raspberry, Elderberry, Cranberry, Red Currant, Black Currant, Gooseberry
	Stone Fruit	Apple, Apricot, Pear, Fig, Cherry, Peach, Plum, Quince
	Tropical	Banana, Pomegranate, Mango, Melon, Papaya, Passion Fruit, Rhubarb
	Dried Fruit	Dried Apricot, Dried Banana, Dried Date, Dried Fig, Dried Plum, Raisin
Floral	Flowers	Geranium, Lavender, Rose, Violet
	Blossoms	Acacia Blossom, Elderflower, Jasmine, Chestnut Blossom, Orange Blossom
Vegetal	Herbs	Basil, Coriander, Mint, Rosemary, Sage, Thyme, Lemongrass, Lemon Balm
	Green	Fennel, Grass, Green Bean, Green Pea, Green Olive, Green Apple, Lettuce-Cucumber, Celery Stalk
	Dry	Hemp, Hay, Hops, Black Tea, Straw, Tobacco, Vanilla
	Cereal	Bamboo Shoot, Basmati Rice, Grain, Corn
Spices	-	Anise, Ginger, Caraway, Nutmeg, Clove, Pepper, Licorice, Juniper Berry, Cinnamon
Wood	Softwood	Resin, Pine, Fir, Spruce, Cedar, Cypress
	Hardwood	Acacia, Beech, Oak, Ash, Chestnut, Cherry, Mulberry, Robinia
Nuts	-	Peanut, Hazelnut, Almond, Chestnut, Nougat, Pine Nut, Pistachio, Sesame, Walnut
Roasted Aromas	Light	Agave Syrup, Maple Syrup, Bread, Honey, Rock Sugar, Popcorn, Toast
	Medium	Bread Crust, Cocoa, Caramel, Malt, Dark Chocolate
	Dark	Ash, Coal, Licorice, Molasses, Smoke, Soy Sauce
Mineral	Earthy	Potting Soil, Carrot, Potato, Roots
	Musty	Algae, Wet Leaves, Moss, Mushrooms, Bark Mulch, Rio, Mold
	Mildewy	Cork, Cardboard, Peat
Chemical	Alcoholic	Cognac, Marzipan, Port Wine, Sherry, Whiskey
	Medicinal	Acetone, Disinfectant
	Sulfuric	Rubber, Cabbage, Sulfur Dioxide, Tar
Microbiological	Animalistic	Meat, Grilled Chicken, Cat Urine, Leather, Wet Fur, Horse Sweat
	Lactic	Blue Cheese, Butter, Cheddar, Yogurt, Cream, Creamy
	Yeast	Yeast, Sourdough

Appendix Q: Tested Aromatic Ingredients mapped to Functionality

		Caffeine	Antioxidants	Minerals
Additional Base Aroma	Green Tea	x	x	x
	Black Tea	x	x	x
	White Tea	x	x	x
	Roiboos Tea		x	x
Secondary Aromas	Heidelbeere		x	x
	Hagebutte		x	x
	Sourcherry		x	x
	Apple		x	x
	Orange		x	x
	Cranberry		x	x
	Granatapfel		x	x
	Lemongras		x	x
	Hibiscus		x	x
	Aroniaberry		x	x
	Cinnamon		x	x
	Vanille		x	x
	Chili		x	x
	Rose Pepper		x	x
	Grapefruit		x	x
	Thymian		x	x

Appendix R: Detailed Overview of Main Lab Learnings

Main Learnings from Lab Testing (mapped to recipe components):	
Raw Material (Cascara)	Flavor profiles of cascara have significant differences depending on the country of origin
	Cascara has an extraction efficiency of 80% on average (between 66% and 92%)
	The efficiency is higher the fewer grams of cascara per liter of water and the more "residual moisture" the cascara still contains
	Shredded cascara has a slightly lower efficiency on the yield (on average 74% (85%) compared to 76% (86%))
	Shredded cascara is much more intense in sensory terms (taste) than the whole cherry
	The optimum conditions for producing a cascara extract are:
	Solid State: Shredded Cascara
	Cascara/Water-Ratio: 60g / 1 liter
	Water Temperature: 77°C
	Infusion Time: 8 min
Secon Base Aroma (Tea Infusion)	Roiboos tea is sensory too dominant and displaces the cascara taste
	White tea is sensory too separated
	Green tea is sensory very dominant, but with a ratio of 10% tea infusion to 90% cascara infusion it is an interesting alternative for certain flavors - but not prioritized
	Black tea is the best sensory alternative to act as a second base component
	Black Tea: A ratio of 20% tea infusion to 80% cascara infusion is optimally balanced
	The optimal conditions (sensory & functional) for producing a black tea extract are:
	Tea/Water-Ratio: 15g tea / 1 liter
	Water Temperature: 95°C
Sweetener	Infusion Time: 4 min
	The optimum sweetening power is 3g-3.5g sucrose per 100ml cascara black tea extract
	Sucrose has the best sensory taste
	As a low-caloric sugar alternative, stevia is best suited in sensory terms with the same sweetening power - possibly with an admixture of erythritol
	Vanillin is very well suited to compensate for the reduced texture (fullness) of the drink when using stevia (due to lower solubility → The water solubility is low at approx. 1.2 - 1.3 g/l)
Edible Acid	Vanillin also reduces the potential licorice-like/slightly bitter aftertaste of stevioglycosides
	Citric acid is best balanced with a dosage of 1g per 1 liter of beverage
Aromas	The pH value of 4.29 is below the critical mark of 4.5 when used in this way
	Best aroma option next to Hibiscus is Blueberry
	Second best option (shared): Pomegranate, Sourcherry
	Berry aromas are super difficult to distinguish - need for a professional sensory analysis
	Niche Flavors (e.g. Chili, Rose Pepper) are very interesting options - but need for large scale testing with target audience to evaluate whether the taste is too niche, even for our target group

Appendix S: Raw Material Testing

Optimal Temperature:	77°C	based on Abduh et al. (2023)
Optimal Extraction Time:	8 min	based on Abduh et al. (2023)

Cascara Origin: Ethiopia						
Test Nr.	Solid State	Cascara/Water Ratio (g/ml)	Temperature (°C)	Extraction Time (Min)	Flavor Rating (1-10)	Flavor Description
1	Whole	4:100	77°C	8 min	4	not intensive at all, very watery, bitter, woody
2	Whole	8:100	77°C	8 min	5	moderate intensity, has fruity notes, moderate bitterness,
3	Whole	12:100	77°C	8 min	3	very intense, super bitter (ash, gummi)
4	Shredded	4:100	77°C	8 min	5	more intensive compared to whole bean, still bitter and watery
5	Shredded	6:100	77°C	8 min	6	very intense, no good flavor profile
6	Shredded	8:100	77°C	8 min	4	too intense, super bitter (ash, gummi) - almost undrinkable

Extraction Efficiency/Loss Calculation (Ethiopia Cascara)							
Test Nr.	Solid State	Cascara (g)	Water (ml)	Brew (g)	Loss	Efficiency	Average
1	Whole	4	100	83	17	83%	76%
2	Whole	8	100	78	22	78%	
3	Whole	12	100	67,5	32,5	68%	
7	Shredded	8	200	163	37	82%	74%
8	Shredded	12	200	151	49	76%	
9	Shredded	16	200	132	68	66%	

Cascara Origin:Columbia						
Test Nr.	Solid State	Cascara/Water Ratio (g/ml)	Temperature (°C)	Extraction Time (Min)	Flavor Rating (1-10)	Flavor Description
10	Whole	8:200	77°C	8 min	5	too watery
11	Whole	16:200	77°C	8 min	8	moderate intense, good balance
12	Whole	24:200	77°C	8 min	7	too sour, very good intensity
13	Shredded	4:100	77°C	8 min	7	fruity in the beginning, medium intensity, very low bitterness
14	Shredded	6:100	77°C	8 min	9	higher sourness in the beginning, very good intensity
15	Shredded	8:100	77°C	8 min	8	high intensity, good sourness, bit too bitter in the end

Extraction Efficiency/Loss Calculation (Columbia Cascara)							
Test Nr.	Solid State	Cascara (g)	Water (ml)	Brew (g)	Loss	Efficiency	Average
10	Whole	4	200	183	17	92%	86%
11	Whole	8	200	172	28	86%	
12	Whole	12	200	161	39	81%	
16	Shredded	8	200	177	23	89%	85%
17	Shredded	12	200	170	30	85%	
18	Shredded	16	200	163	37	82%	

Appendix T: *Second Base Aroma Testing*

Optimal, Functionality-enhancing Tea Brewing Conditions acc. to literature:				
Tea Type:	Green Tea	Black Tea	White Tea	Roiboos Tea
Water (ml)	2g/200ml	3g/200ml	2g/200ml	4g/200ml
Temperature (°C)	70-80	90-100	70-80	100
Extraction Time	2-3min	3-5min	2-5min	5-10min
Source	Senanayake (2013)	Winiarska-Mieczan & Baranowska-Wojcik (2024)	Kowalska et al. (2021)	Joubert & Schultz (2012)

Test Nr.	Tea Type	Cascara Brew (%)	Tea Brew (%)	Flavor Rating (1-10)	Flavor Description
1	Green Tea (Jasmin)	90	10	8	soft taste, floral, good intensity of tea and best balance, still higher "tea-taste" compared to black tea, more separate, 2nd best tea option - not favorite
2	Green Tea	80	20	7	still too intense taste of the green tea
3	Green Tea	70	30	6	Interesting new taste, very dominant tea taste
6	Black Tea	90	10	6	not intense enough, almost not tasting black tea
7	Black Tea	80	20	10	best balance, very good taste, reduces bitterness of cascara, dominant casacara taste
8	Black Tea	70	30	8	good option, way better balance, still slightly dominant black tea, overall good taste harmony
9	Black Tea	60	40	7	still too intense taste of the black tea, no good balance
10	Black Tea	50	50	5	too intense taste of the black tea, no good balance
11	White Tea	90	10	N/A	no further testing was necessary
12	White Tea	80	20	N/A	no further testing was necessary
13	White Tea	70	30	5	totally boring, separate and dull taste doesn't enhance the taste experience
14	Roiboos Tea	90	10	N/A	no further testing was necessary
15	Roiboos Tea	80	20	N/A	no further testing was necessary
16	Roiboos Tea	70	30	4	bad taste, similar taste profile enhances "bad parts of the flavor profile" => more bitterness

Optimal base-mix -brew acc. to tests:		
Cascara Brew	Cascara (g)	6
	Water (ml)	100
	Temperature	77°C
	Extraction Time	8min
	Ratio	80%
Tea Brew	Black Tea	3
	Water (ml)	200
	Temperature	95°C
	Extraction Time	3min
	Ratio	20%

Appendix U: Secondary Aroma Testing

Secondary Flavoring Aroma Testing				
Test Nr.	SFA	Type of SFA	Amount/100ml base mix	Flavor Description
1	Blueberry	Juice	10ml	Best overall; fruity, balanced with the cascara base. Clear favorite next to hibiscus
2	Rose hip	Powder/Extract	10ml	Bad taste; powdery, bitter - not a good match
3	Sourcherry	Juice	10ml	third best option, fruity - a bit too much acid - but still good taste balance, good option
4	Apple	Aroma/Extract	0,01-0,1ml (drops)	good taste & option, still a bit "boring", no add of complexity
5	Orange	Aroma/Extract	0,01-0,1ml (drops)	Fruity, Fresh, good option for future product variations - a bit to artificial due to the aroma used
6	Cranberry	Juice	10ml	Refreshing, but too much acid, not the best balance, made the taste "lighter" -
7	Pomegranate	Juice	10ml	very good; rich and fruity with depth. Close to blueberry and hibiscus.
8	Lemongras	Aroma/Extract	0,01-0,1ml (drops)	very niche, not so good harmony, taste match a bit off
9	Hibiscus	Powder/Extract	10ml	still favorite (next to blueberry) - refreshing, light but not too much acid - keeps taste "Full"
10	Aroniaberri	Powder/Extract	0,01-0,1ml (drops)	not good, powdery as well, too dull and bitter
11	Cinnamon	Powder/Extract	0,1-0,5ml	Interesting, very present, especially in the smell, totally dominant and very wintery
12	Vanille	Powder/Extract	0,1-0,5ml	Awesome taste note, but not as primary aroma, rather slightly in the background
13	Chili	Powder/Extract	0,1-0,5ml	super niche taste, is interesting - needs further testing with target group
14	Rose Pepper	Powder/Extract	0,1-0,5ml	super niche taste, is interesting - needs further testing with target group
15	Grapefruit	Aroma/Extract	0,01-0,1ml (drops)	Too bitter; overpowering and unbalanced compared to orange or lemon.
16	Thymian	Aroma/Extract	0,01-0,1ml (drops)	herbs are a good option as a third aroma (in the back) - not for first product version

Appendix V: *Sweetener Testing*

Sweetness Intensity Test (Sucrose)		
Test Nr.	Amount/100ml Cascara Brew	Flavor Description
1	1g	too less sweetness
2	2g	little bit more sweetness possible, but already good
3	3g	good sweetness balance
4	4g	good sweetness balance
5	5g	too sweet
6	6g	way too sweet
7	2.5g	too less sweetness
8	3.0g	has the best balance
9	3.5g	good balance, with little
10	4.0g	too sweet

Low-Caloric Sweetener Tests:				
Test Nr.	Sweetener	Adapted amount based on Sweetness Intensity/100ml	Flavor Description	Rank
1	Xylitol	3.0g	very similar to Erythrit, hard to distinguish, sweetness doesn't enhance the balance that much, light	3
2	Stevia	0.1g	tasty sweetness, slightly bitter aftertaste	1
3	Erythrit	3.9g	less sweet taste with our intensity, doesn't enhance balance/ratio	3
4	Agave Syrup	4.5g	very tasty, a bit too sweet with our intensity	2
5	Coconut Sugar	3.3g	no good tasting sweetness,	5

Appendix W: *Edible Acid & ph-Value Testing*

Citric Acid & pH Value Test				
Test Nr.	Acidifier	Amount/100ml Cascara-Black-Tea Brew	ph-Value	Flavor Rating
1	Citric Acid	0,1g	4,29	best balance & taste
2	Citric Acid	0,2g	4,17	okay balance, still little sour
3	Citric Acid	0,3g	4,13	too sour
4	Citric Acid	0,4g	4,08	way too sour

Appendix X: *User Tasting Survey – Taste related questions*


Cascara Collective

+ :: Welcome to your Tasting Experience of our Cascara Drink!

Help us find the perfect taste!

Let's try →

Page 2

How would you rate the overall taste of our drink? *

1 2 3 4 5 6 7 8 9 10

very bad very delicious

What do you think about: *

	less	just right	more
Sweetness	☐	☐	☐
Sourness	☐	☐	☐
Bitterness	☐	☐	☐
Intensity	☐	☐	☐
Carbonation	☐	☐	☐

Appendix Y: Overview of Tasting Events

Event:	Nova Surf Festival	KPMG User Testing	Prototyping Fund Final Showcase
Survey Participants	33	20	36
Date	05/10/2024	14/11/2024	25/11/2024
Location	Costa da Caparica	NOVA SBE	NOVA SBE
Event Description	Annual festival organized by the NOVA Surf Club in Costa da Caparica, featuring surfing contest, community activities and a marketplace	User testing event hosted by DESIS LAB at NOVA SBE	Final showcase of prototypes developed by project teams as part of the EU-funded Prototyping Fund program, organized by DESIS LAB
			

Appendix Z: Survey Results – Beverage Overall Taste

Survey Question:						
How would you rate the overall taste of our drink?						
Nova Surf Festival		KPMG User Tasting		Prototyping Fund Showcase		
N = 33		N = 20		N = 36		
Respondent ID	Rating (1-10)	Respondent ID	Rating (1-10)	Respondent ID	Prototype 1 - Rating (1-10)	Prototype 2 - Rating (1-10)
BARggA	8	gk6bbj	10	2746Gg	8	6
X1bgAe	8	rkMD6N	7	yzlQNB	7	6
GXPgEO	7	jkAexx	10	G5rGVj	8	8
1Da5Jb	7	V4OpYv	7	NMZyOl	8	8
rGZWro	8	xl5ry5	8	B0GvLN	6	4
WD7dDk	7	PGJpaV	6	rkMBdo	7	5
EvOYNr	8	DZ6Kzj	7	RkzEdd	8	9
NMZyOl	5	dkeN6N	6	gv5K81	8	6
GXPpy2e	8	5pP4LQ	9	274Q6b	9	8
oKj1eP	6	QOIMY1	8	KkMqV8	8	9
rGbaDN	10	rkMBdo	8	OkAWyY	8	8
bKJyXL	5	6pEeQA	8	YkZEyv	8	6
Vv6Aaj	8	aaqeP9	5	OkApZa	8	9
oKj1WX	6	6pEZ1P	7	274qYe	8	10
lKE1P6	10	B2Wx85	7	OkP1WR	8	7
yjapMd	7	X2P4zO	8	bvk5x2	8	9
Vv6B0y	6	KaKVyK	7	EM1kXq	8	9
ZvBL1a	7	PGJ5Re	6	jvMaGQ	6	8
GXPjq2	5	PGJXDd	6	KaKVyK	8	9
Vv6BqN	6	5pPPd6	8	PGJ5Re	8	7
Rv96pd	6			bvkZ1o	8	9
AAXO1k	6			bvkqQZ	8	7
kKPXGd	5			DM1BQq	10	9
YpAXGz	7			zLzNqk	7	6
qolXG8	7			DM1KeN	7	4
216zKM	6			lvAqXV	9	10
X1bdDP	3			NdVDvN	8	6
rGZRdR	6			bvkjd2	8	6
AAXNNo	10			16KdG1	8	5
aKMXJ2	8			OkP4pY	7	5
yjar8d	6			LkGKPj	8	7
8AIV9z	8			dvA0LD	6	8
rG4Od5	4			LkGP7I	9	9
				jvMIMa	7	8
				avxd5W	6	5
				VDIjdl	8	7
Average Rating	6,79		7,40		7,75	7,28

Appendix AA: Survey Results – Beverage Intensity

Survey Question:						
What do you think about: [Intensity]?						
Nova Surf Festival		KPMG User Tasting		Prototyping Fund Showcase		
N = 33		N = 20		N = 36		
Respondent ID	Rating (less; just right; more)	Respondent ID	Rating (less; just right; more)	Respondent ID	Prototype 1: Rating (less; just right; more)	Prototype 2: Rating (less; just right; more)
BARggA	just right	gk6bbJ	just right	2746Gg	just right	less
X1bgAe	just right	rkMD6N	less	yzlQNB	more	just right
GXPgEO	just right	jkAexx	just right	G5rGVj	just right	just right
1Da5Jb	just right	V4OpYv	just right	NMZyOl	just right	less
rGZWro	just right	xl5ry5	more	B0GvLN	just right	less
WD7dDk	more	PGJpaV	less	rkMBdo	just right	less
EvOYNr	more	DZ6Kzj	just right	RkzEdd	just right	just right
NMZyOl	just right	dkeN6N	just right	gv5K81	just right	less
GXPY2e	more	5pP4LQ	just right	274Q6b	just right	just right
oKj1eP	more	QOIMY1	just right	KkMqV8	just right	just right
rGbaDN	just right	rkMBdo	just right	OkAWyY	just right	just right
bKjyXL	just right	6pEeQA	just right	YkZEyv	just right	just right
Vv6Aaj	more	aaqeP9	less	OkApZa	just right	more
oKj1WX	more	6pEZ1P	just right	274qYe	just right	just right
lKEIP6	just right	B2Wx85	just right	OkP1WR	just right	just right
yjapMd	more	X2P4zO	just right	bvk5x2	just right	just right
Vv6B0y	more	KaKVyK	just right	EM1kXq	just right	just right
ZvBL1a	more	PGJ5Re	less	jvMaGQ	just right	just right
GXPjq2	more	PGJXDd	more	KaKVyK	just right	just right
Vv6BqN	just right	5pPPd6	less	PGJ5Re	just right	just right
Rv96pd	just right			bvkZ1o	more	just right
AAXO1k	just right			bvkqQZ	just right	just right
kKPxGd	less			DM1BQq	just right	just right
YpAXGz	less			zLzNqk	more	just right
qolXG8	just right			DM1KeN	just right	less
216zKM	more			lvAqXV	just right	just right
X1bdDP	less			NdVDvN	more	more
rGZRdR	just right			bvkjd2	just right	less
AAXNNo	just right			16KdG1	just right	just right
aKMXJ2	more			OkP4pY	more	just right
yjar8d	just right			LkGKPj	just right	just right
8AlV9z	more			dvA0LD	just right	just right
rG4Od5	just right			LkGP7l	just right	just right
				jvMlMa	just right	more
				avxd5W	more	more
				VDlJdl	just right	just right
	Absolute		Absolute		Absolute	Absolute
Less	3		5		0	7
Just right	17		13		30	25
More	13		2		6	4
	Relative		Relative		Relative	Relative
Less	9,1%		25,0%		0,0%	19,4%
Just right	51,5%		65,0%		83,3%	69,4%
More	39,4%		10,0%		16,7%	11,1%

Appendix AB: Survey Results – Beverage Overall Taste



Appendix AC: Advantages and Disadvantages of Pasteurization Methods

	Advantages	Source	Disadvantages	Source	Overall Learning
Flash Pasteurization	More energy-efficient due to shorter processing time (Pereira & Vicente, 2010).	(Pereira and Vicente 2010)	Recontamination Risk is higher, since pasteurization happens before filling/packageing	(Lewis and Heppell 2000)	Flash pasteurization offers better flavor preservation but comes with a higher microbiological risk.
	Preserves flavor, color, and nutritional value better than traditional pasteurization methods	(Lado and Yousef 2002)	Less Control & Monitoring possible -> higher risk of uneven treatment	(Suggs 2023)	
Tunnel Pasteurization	Pasteurizes both the product and the packaging, reducing post-processing contamination risks	(Lewis and Heppell 2000)	Longer heat exposure causes significant oxidation, leading to accelerated aging and browning of the product (quality loss)	(Schneidermann 2012)	Tunnel pasteurization minimizes microbiological risk but compromises flavor quality more than Flash Pasteurization
			Higher operational costs, compared to flash pasteur	(Schneidermann 2012)	
			Higher energy consumption due to the need to heat both product and packaging	(Pereira and Vicente 2010)	