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Designing a Trangia Coffee Brewer

A User- and Brand-Centred Product Development Project

Master's Thesis in Product Development

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DEPARTMENT OF INDUSTRIAL AND MATERIALS SCIENCE

Chalmers University of Technology
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Coffee Accessories with Trangia
a User and Brand-Centred Product Development Project
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Cover: [Photo of the final prototype being used to brew coffee in the outdoors.]

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Abstract

This master's thesis explores the development of a specialised coffee brewing accessory tailored for Trangia AB, a leading Swedish manufacturer of outdoor cooking stoves. The aim of the project was to create a simple, reliable brewing solution that enriches the outdoor experience, uniting contemporary coffee habits with Trangia's core values of sustainability, simplicity, and backwards compatibility.

Through an exploratory design process involving benchmarking, brand analysis, and qualitative user research, the needs of the primary target user groups were identified. By utilising iterative concept generation methods such as brain drawing, rapid physical prototyping, and evaluation matrices, multiple brewing mechanisms were explored.

The final selected concept is the ”Auto Drip”, an innovative solution that brings drip coffee to the outdoor segment. Powered by the stove's heat, the device utilises the principles of a percolator, collecting steam in a pump base to push boiling water through a pipe and into a filter holder. This design provides a highly desirable ”set it and forget it” experience while delivering consistent drip coffee in the field.

Prioritising packability and seamless integration, the lightweight metal components pack flat within Trangia's existing 25 and 27 stove systems. Ultimately, the project resulted in a robust, modular accessory that maintains a visual language that respects Trangia's heritage while meeting modern campers' expectations for reliable outdoor functionality.

Keywords: Product Development, Outdoor Coffee, Coffee Brewing, Trangia, Auto Drip, User Needs, Sheet Metal Design.

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Many people have generously taken time out of their lives to help us understand the user needs, building the backbone of this development project. A big thank you to everyone who chose to participate in the interviews and observations held.

A lot of prototyping was done in this project. Thanks to Chalmers Fuse and its employees, we were able to build and test rapidly, which helped the development immensely. A special thank you to Peter Bäckgren at Fuse, who showed interest in our project and provided support in constructing the prototype.

Agust Lindh & Rasmus Östman, Gothenburg, June 2026

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1

Introduction

Outdoor expeditions, from casual camping trips to challenging treks, demand equipment that balances portability with reliability. For many outdoor enthusiasts, the portable stove is an essential tool for preparing hot meals and providing comfort in harsh conditions. As outdoor activities attract an increasingly diverse audience, intuitive, robust and thoughtfully designed products are essential.

For decades, Trangia AB, a leading Swedish manufacturer of portable stoves, has provided robust solutions for outdoor cooking. Since its founding in 1925, Trangia, which operates from its factory in Trångsviken, a small town in Jämtland, Sweden, has emphasised functional, durable designs intended for lifelong use. The company's flagship product has historically been, and remains, the classic ”Trangia Stove”.

The Trangia Stove comes in two sizes: the larger 25 and the smaller 27. Its standard configuration includes a two-part wind protector, a spirit burner, two pots, a frying pan, and a handle (see the left side of Fig. 1.1). The Trangia stoves can be disassembled and packed into a smaller form factor for transport (see right side of Fig. 1.1).

Figure 1.1: Left: All parts of a standard issue Trangia stove (25-UL-1). Right: The same Trangia stove in its packed position.

1.1 Preliminary Brief and Aim

This report presents a Master's thesis project conducted in collaboration with Trangia AB by two graduate students at Chalmers University of Technology. The brief given by Trangia was named ”Coffee Accessories” and related to strengthening Trangia's position in the coffee brewing segment. Today, Trangia's only coffee-related equipment is the kettle, designed for making cowboy coffee (see left side of Fig. 1.2). Trangia also sells cowboy coffee in collaboration with a local coffee roaster (see right side of Fig. 1.2).

Figure 1.2: Left: the Trangia kettle (25) made to be used for the Trangia stove. Right: ”Trangia Traditional Kokkaffe”, the cowboy coffee Trangia currently sells.

The aim of this project is then to develop a new coffee-brewing solution tailored to Trangia's product ecosystem and manufacturing constraints. The project will cover the full product development process, from research and concept development to prototyping and evaluation, resulting in a practical, user-centred, and production-friendly design.
To achieve the goal of a new good coffee brewer, guiding questions were formulated to guide the project's development.

Guiding questions:

1. What are the relevant user groups and market segments for outdoor coffee brewing, and which segment should be prioritised for a Trangia-compatible solution?
2. How do users perceive and prepare coffee during outdoor activities, and what are their needs for brewing products?
3. What functional, ergonomic, and experiential requirements define a successful brewing solution in an outdoor context?
4. How can a new brewing solution be designed to remain compatible with Trangia's existing stove systems and packing logic?
5. How can Trangia's manufacturing constraints, particularly sheet-metal forming, inform and shape the product design?
6. In what ways can a new brewing solution align with Trangia's brand values while meeting modern user expectations?

1.2 Process Overview

The project can be split into two main parts: a pre-study section to understand the problem and a product development section to solve it (see timeline Fig. 1.3). The pre-study focuses on the context and the user, and on how Trangia, as a brand, affects future concepts. In contrast, product development focuses on exploring different solutions through iteratively expanding and narrowing the idea space until one final concept remains. This description of the workflow is a simplification; in practice, the process was highly iterative, requiring frequent transitions between phases, especially when new information emerged or assumptions proved false.

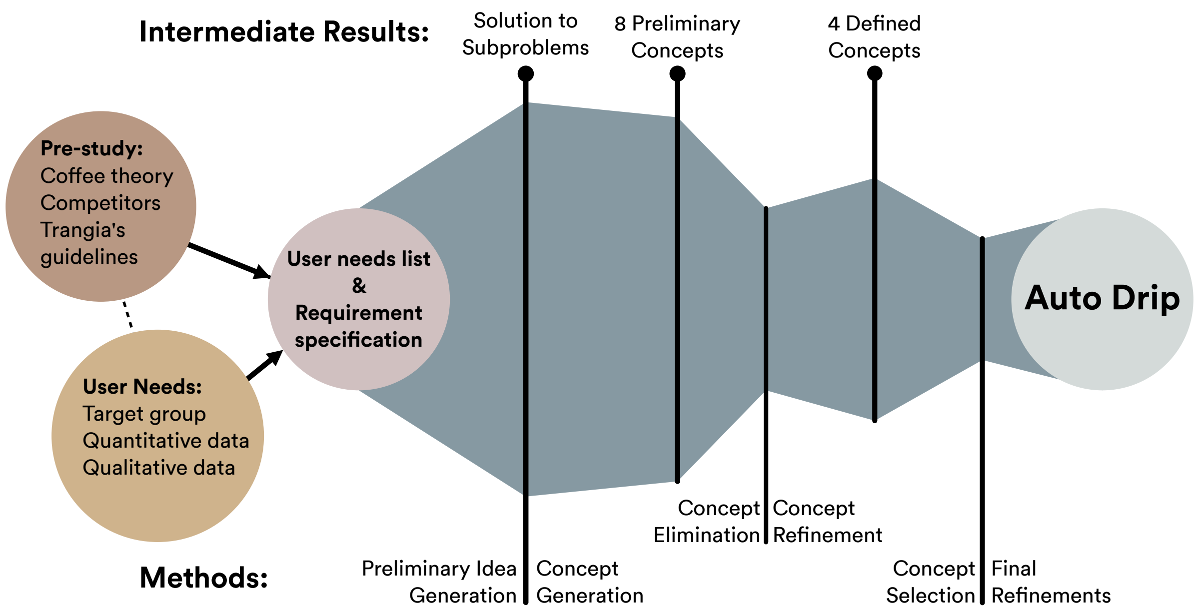


Figure 1.3: A rough timeline showing the different stages of the project, beginning with the pre-study, which transforms into the product development process, which results in the finished Auto Drip concept.

1.2.1 Delimitation

This project is strictly limited to the active process of coffee brewing. Thermoses and other long-term storage solutions for brewed coffee fall outside the scope of this research and will not be addressed. It is therefore important to understand in what context a thermos is most suitable, or when brewing the coffee on-site is preferred. The thermos excels in shorter day trips, 1-4 cups in total, where time and efficiency are valued. Brewing coffee on-site is better suited to longer trips, multiple brews without restocking, and situations where taste and experience are valued more highly.

2

Coffee Brewing Theory and Food Safety Requirements

This chapter provides the theoretical foundation necessary for developing an outdoor coffee product. It explores the science of coffee extraction, various brewing methods, contemporary coffee consumption, and the essential food safety standards and regulations that the final product must meet.

2.1 Coffee

From a technical perspective, coffee preparation is an extraction process in which water serves as a solvent to dissolve chemical compounds from the roasted and ground seeds of the Coffea plant. The final quality of the beverage is determined by a multitude of variables, ranging from the coarseness of the coffee grounds to the water temperature.

This section covers the fundamental principles of coffee science and categorises the most common brewing methods by their extraction mechanisms.

2.1.1 Coffee Grounds

Grinding coffee converts the whole coffee beans into powder that can later be used to brew coffee. The main variable when grinding coffee is the particle size. Different brewing methods call for different grind sizes, often denoted as fine to coarse. The finer the grind, the more surface area the coffee has, making it easier to extract more flavours. But different filtration methods handle particles of different sizes, making some unsuitable for finer coffee grounds. This is because the grounds will not be filtered out and will therefore end up in the coffee, resulting in a generally unpleasant texture. Finely grinding coffee can also result in “channelling” in percolation (when water flows through the coffee) methods, because the water forms channels in the coffee bed and does not extract the coffee evenly, resulting in a weaker cup of coffee than a larger grind would (James Hoffmann, 2018).

2.1.2 Brewing Process

The goal when brewing coffee is to extract the appropriate amount of chemicals and particulates from the coffee grounds to match your specific preferences.

The chemicals extracted from the coffee grounds can be roughly separated into two categories: desirable and undesirable. Desirable, readily water-soluble compounds such as sugars, organic acids, and aromatic volatiles contribute to the generally pleasant taste of coffee. The undesirable compounds are generally less soluble and require higher temperatures and longer times to dissolve; these include phenylindanes, astringent compounds, and tannins, which are generally perceived as bitter, harsh, and ashy. (Genovese et al., 2025).
During coffee brewing, varying amounts of the coffee grounds' fibres and cellular structure end up in the finished coffee as particulates. This depends on the grinding used and the filtration method. The more particulates that end up in the coffee, the more opaque it gets. The particulates give the coffee more "body", often described as "mouth feel". An excess of particulates has also been described as muddying the coffee, making it harder to distinguish clear flavour notes (James Hoffmann, 2018).

2.1.3 Brewing Methods

In general, coffee brewing methods can be divided into two main categories: immersion and percolation, depending on how the coffee grounds and water interact.

Immersed means the coffee grounds are submerged in water for a period of time, forming a coffee solution that can later be separated. This type can be further split into two groups: decoction (simmering the coffee) and infusion/steeping (mixing with hot water). Cowboy coffee is a notable decoction method in which coffee is brewed in hot water. An example of infusion is the French press, in which coffee grounds are mixed with hot water.
The other main method is percolation, in which water moves through the ground coffee. This can also be further separated into pressure percolation and non-pressure percolation, normally just called percolation. In pressure-percolation, the water moving through the ground is under pressure (0.5 bar +), whereas in non-pressure-percolation, it moves through the ground without any real pressure. Espresso is the clearest pressure-percolation method, where water at 9 bars percolates through the coffee. An example of non-pressure percolation is the pour-over, in which hot water is poured over the coffee grounds, allowing gravity to slowly percolate the water through the coffee bed (James Hoffmann, 2018). See Table 2.1 for more information about the main coffee

brewing methods.

Table 2.1: 9 different coffee brewing methods and descriptions about them

Method	**Category**	**Most Common Filter Type**	**Taste Profile**	**Short Process Description**
Cowboy Coffee	Immersion (Decoction)	None	Rustic and bold	Coffee grounds are boiled directly in water and settled by gravity.
French Press	Immersion (Infusion)	Metal	Rich and savory	Grounds steep in hot water before being separated by a coarse metal mesh.
AeroPress	Mix	Paper/Metal	Sweet and versatile	Uses a combination of immersion and pressure to force coffee through a filter.
Vacuum Pot	Mix	Cloth/Paper	Crisp and vibrant	Vapor pressure pushes water up to brew, then a vacuum pulls it back through a filter.
Pour Over	Percolation (Gravity)	Paper	Bright and nuanced	Hot water is poured over a bed of coffee, extracting flavor as it drains through a filter.
Drip	Percolation (Gravity)	Paper	Clean and consistent	An automated method where water drips through coffee into a carafe.
Percolator	Percolation (Gravity)	Metal	Pungent and intense	Boiling water is continuously cycled through coffee grounds, often over-extracting.
Moka Pot	Percolation (Pressure)	Metal	Sharp and intense	Steam pressure forces hot water upward through tightly packed coffee.
Espresso	Percolation (Pressure)	Metal	Complex and powerful	Highly pressurized water is forced through a fine puck of coffee in seconds.

The difference between the categories is somewhat arbitrary and is not very clear-cut. The categories are meant to help one understand the general differences between methods. Some products fall in between and are a mix of the different categories, for example, the AeroPress. When brewing with an AeroPress, there are two distinct steps: one for steeping and one for percolation (James Hoffmann, 2018). To see Fig. 2.1 on how different methods sit on an analog percolation to immersion scale.

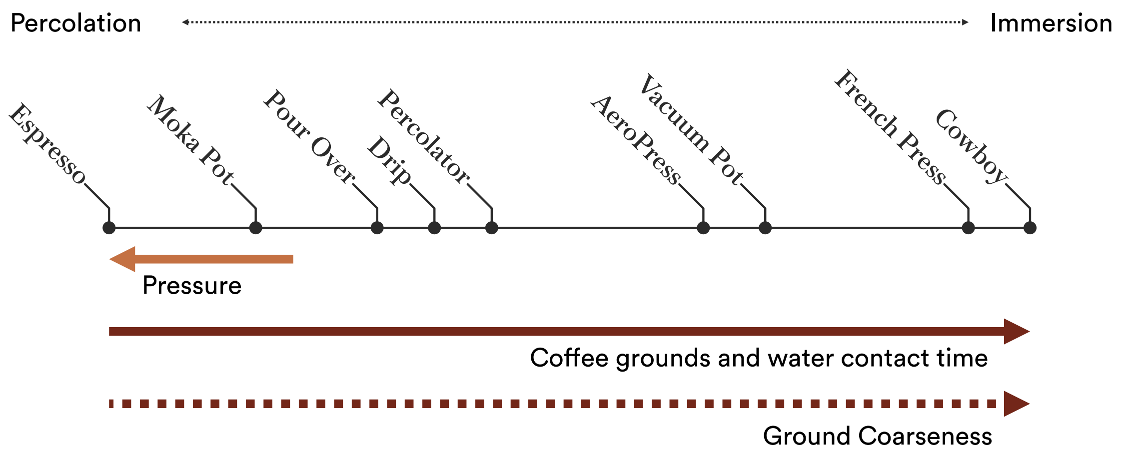


Figure 2.1: The different brewing methods on a line based on how much percolation vs immersion the coffee grounds experience

2.1.4 Coffee Degradation

Roasted coffee beans have a shelf life of about a year, but their flavour degrades slowly; after a few months, a noticeable decline in flavour develops. Coffee grounds, with their much higher surface area, degrade quickly and are perceived by coffee connoisseurs as losing flavour in days or even hours when exposed to air. A finished cup of coffee degrades significantly depending on the temperature at which it is held. If left on a heating plate, the coffee will get "burnt" and develop an unpleasant taste rather quickly. If left to cool in the air, the coffee degrades in taste in about an hour.
(James Hoffmann, 2018).

2.2 Swedish Coffee Habits

In Sweden, coffee consumption is spread out across age groups. The coffee consumed in Sweden is generally strong filter coffee from a large cup. In fact, the preference is strong for filter coffee - 73% of Swedes surveyed by (Löfbergs, 2025) reported that they drink filter coffee. Emerging Swedish trends include iced coffee, which has seen continued growth. The practice of grinding your own coffee is also growing in popularity, with 27% of Swedes grinding their own coffee in 2025 (Löfbergs, 2025).

2.3 Standards and Regulations

The most important regulations regarding coffee-making equipment are the EU Regulations No. 1935/2004 and No. 2023/2006.
1935/2004 affects food contact materials. The materials in contact with food are not allowed to leach into the food at a level that's harmful to human health or that changes the composition, taste, or odour. It also states that the product must be traceable, so that if any product fails to comply, it can be recalled and the root cause identified. Lastly, it regulates the use of the "wine glass and fork symbol" that signals that a product is meant to handle food ("Regulation - 1935/2004 - EN - EUR-Lex", 2023)
2023/2006 regulates the manufacturing process and requires compliance with GMP (Good Manufacturing Practice). The manufacturing process must be stable and not contribute to any contamination of the final product. To be allowed to sell the product, the manufacturer must demonstrate that the product complies with GMP at all stages. This is done by ensuring that the suppliers and contractors also follow the GMP ("Regulation - 2023/2006 - EN - EUR-Lex", 2023).
To validate that the product complies with regulations, a lab test is required to ensure it does not contaminate the food it contacts. The lab test serves as the basis for

a declaration of compliance, with all relevant parties (manufacturers, suppliers, etc.) signing to confirm that the product complies with the regulations.

For this project, validation will be conducted by comparing the product against existing food-safe geometries and materials, minimising design compliance risks prior to formal testing.

3

Brand Identity and Product Ecosystem

To ensure the new coffee accessory aligns seamlessly with Trangia's heritage, this chapter investigates the company's brand identity, business model, and existing product ecosystem. It outlines the methodologies used for this analysis and presents the findings that guide the final design format.

3.1 Methods

This section describes the methods used to gather information about the project's context and provides a deeper understanding of Trangia. Understanding Trangia's existing product design and manufacturing processes helps guide future design work to ensure the product fits Trangia's brand and capabilities.

3.1.1 Company Analysis

A company analysis, including the identification of brand values, a graphical profile, and the business model, was conducted. Data were mainly gathered from Trangia's website and from conversations with project supervisor Jonas Dahlgren from Trangia.

Business Model Canvas

The Business Model Canvas is a tool which helps visualise the big picture of a business and aids understanding and discussion. (Osterwalder & Pigneur, 2010). For this project, the main purpose was to establish a common, foundational understanding of Trangia's business and key considerations to guide product development and make future discussions within the project group easier.

Project map

To gain a general understanding of Trangia's product strategy and identify which product types might be most relevant to develop, a project map in the form of a product/process change matrix, based on (Wheelwright & Clark, 1992), was constructed, mapping an assortment of Trangia's product range.

Mood Board

A mood board can serve several purposes, including communicating style and representing emotion. (Garner & McDonagh-Philp, 2001). In this project, the main purpose of the mood board was to visually represent Trangia's brand values and serve as a unifying picture of the brand's feeling, which the developed product should match. The method used to construct the mood board differed from the six key activities suggested by Garner and McDonagh-Philp, 2001. For each of Trangia's brand values, images that represented them were collected. Colours were selected from Trangia's brand palette, and through iteration, the images and colours were integrated into a cohesive board that accurately represented the brand's essence.

3.1.2 Product and Production Analysis

An analysis of Trangia's products and production was conducted to identify the core characteristics of Trangia's current assortment that the developed product must adhere to. This included a compilation of the product range, materials, and manufacturing methods, as well as a Design Format Analysis (DFA) to define the brand's visual language. Information was mainly sourced from Trangia's website and from conversations with project supervisor Jonas Dahlgren from Trangia.

Design Format Analysis

A descriptive design format analysis is a tool for evaluating the design format of a product range (Warell, 2001). The analysis was performed by firstly extracting nine of the most important design characteristics of the most central product in Trangia's range - the traditional stove system. Secondly, 15 products were selected from the Trangia product range and rated from 0 to 2 based on their adherence to the design characteristics. By analysing the recurrence of visual ingredients across a selection of Trangia products, a few recurring elements could be identified and used as guidelines for the product's design format.

3.1.3 Mission statement

To ensure alignment within the project group, a mission statement was formulated to provide a shared objective. Following the theory by Ulrich et al., 2020, this document outlines the project's scope, target markets, and key assumptions. This created a strategic foundation that helped future design decisions remain consistent with the project's initial goals.

3.2 Results

This section presents the results of the analysis of Trangia and its current products, which aim to provide guidance for future product development.

3.2.1 Company Analysis

The company analysis helped form a clear baseline for the project. By examining Trangia's brand values and business model and gaining a holistic understanding of the company, the development could be guided to ensure the new product aligns with the company's identity and way of working.

Trangia's Brand Values

Upon analysing Trangia's image in marketing materials and online presence, it quickly became clear that reliability and tradition are important brand signifiers. The "Lasts a lifetime. Or three..."-slogan and the emphasis on their roots in Trångsviken, Sweden, are examples of how this is conveyed.

Accessibility is also an important value for Trangia. "Our purpose to get more people outside is a strong motivator and felt by all who work here, because those moments are the moments that truly matter in life" (Rydell Magnus, n.d.).

Finally, Trangia values sustainability, as shown not only by responsible manufacturing practices but also by developing modular, backwards-compatible products with extended lifecycles and ensuring the availability of spare parts.

Trangia's values as a brand can then be stated as these four main areas:

Reliability

Reliability is achieved through high-quality products with a simple construction.

Sustainability

Sustainability is achieved through products that are durable, modular, backward compatible, and easy to repair.

Tradition

Trangia takes great pride in its heritage, prioritising incremental improvements over catching the latest trends. New products must respect existing ones.

Accessibility

Creating access to moments in nature through robust products with a low entry barrier.

Business Model Canvas

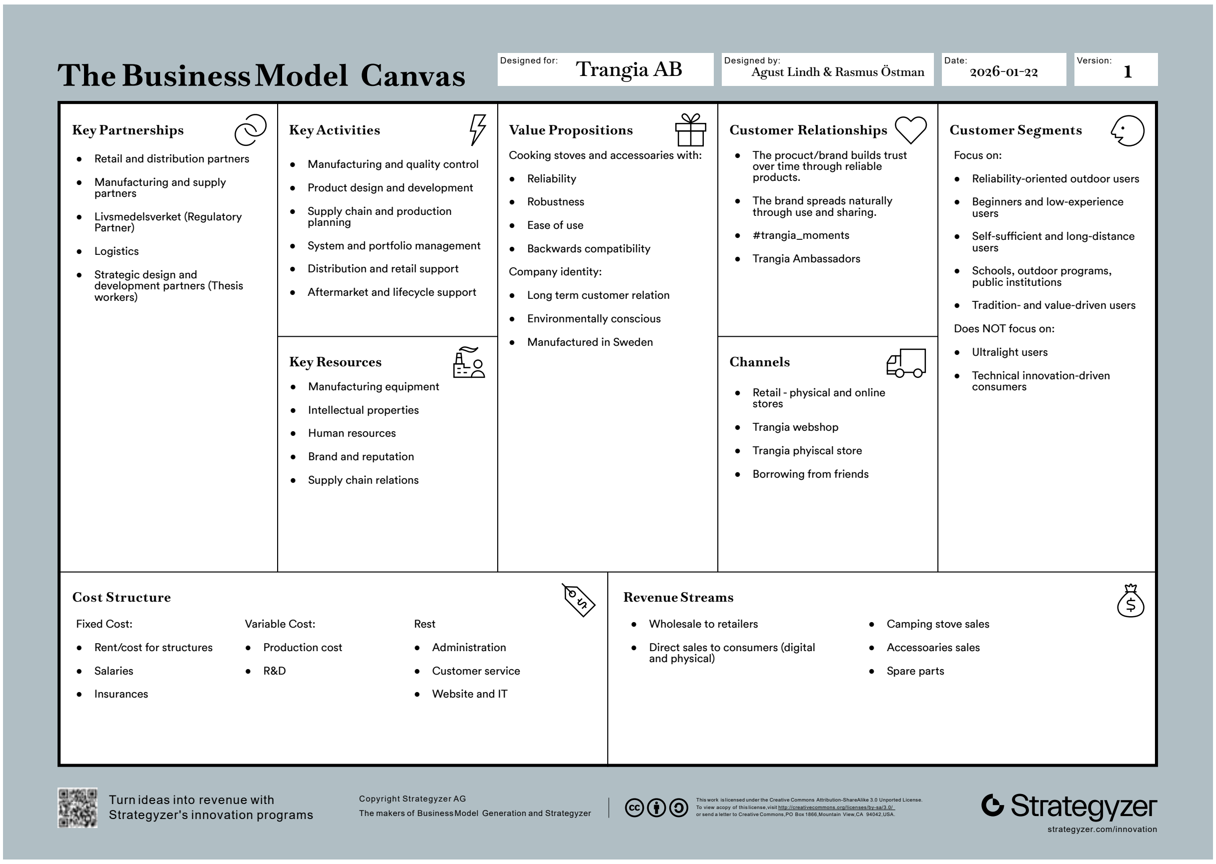


Figure 3.1: Business Model Canvas implemented for Trangia AB.Note. Adapted from (Strategyzer, 2025), used under CC BY-SA 3.0.

Trangia's business model focuses on delivering reliable, robust, and backwards-compatible outdoor cooking systems to customers ranging from first-time campers to experienced hikers. The company leverages its Swedish heritage and strong brand reputation to maintain long-term customer relationships. Revenue is driven by the sale of stoves, accessories, and spare parts through retailers and directly to consumers, mainly through their web shop. The brand emphasises a value proposition centred on tradition and sustainability over rapid technological innovation. When developing a new product, it is not only important to consider and utilise current key resources, activities, and partners, but also to ensure the product aligns with the value proposition and customer segments.

Project map

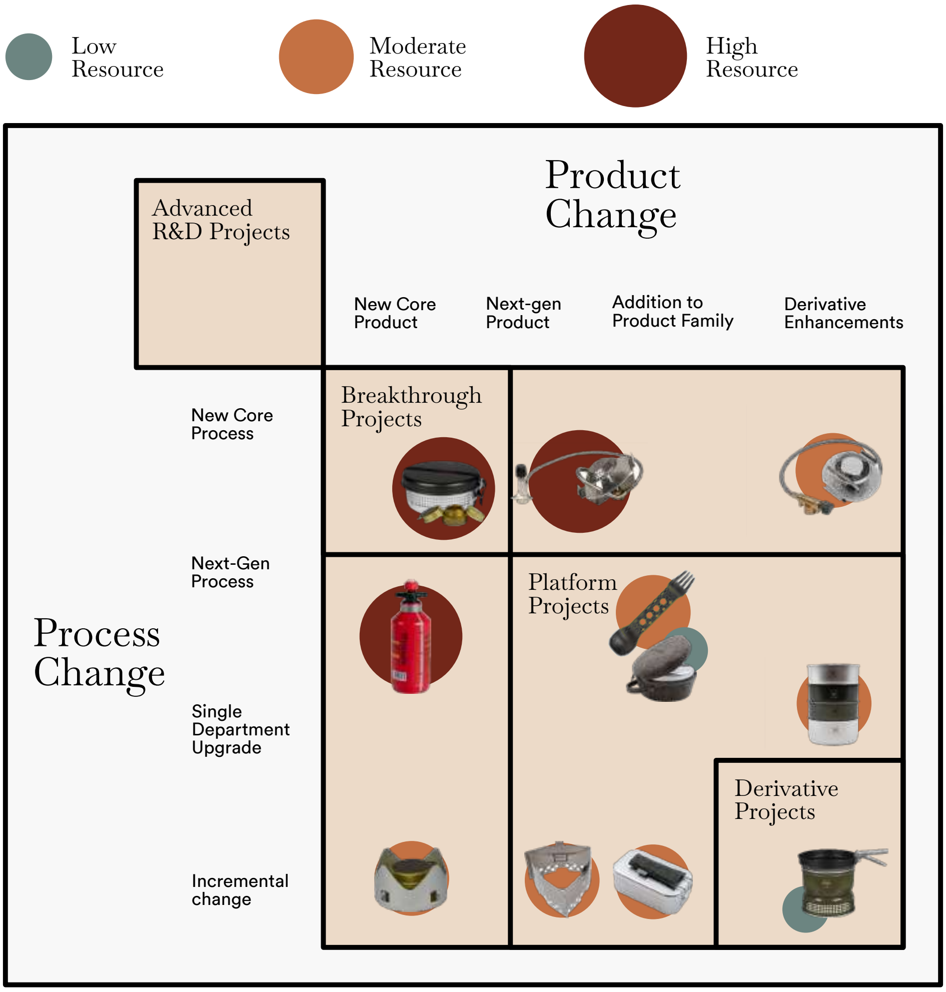


Figure 3.2: Project map for Trangia's projects historically. Note. Adapted from (Wheelwright & Clark, 1992)

Fig. 3.2 maps some of Trangia's past projects onto a product/process change matrix. Dot sizing represents the estimated relative resource demand for each project. This visualisation provides an overview of Trangia's product portfolio and dispersion of product types. An analysis of the project map shows that most resource-intensive projects are directly related to cooking stoves. It is also clear that more recent projects are generally less groundbreaking and focus more on further development and support of existing solutions. The focus on derivative projects, such as add-ons to existing stove systems, was also confirmed in discussions with Trangia. When developing a new product, it is clear that it must respect both other products and their manufacturing methods to fit within the broader Trangia context.

This relatively low focus on breakthrough projects aligns with Trangia's main principles of tradition and high backward compatibility.

Moodboard

The moodboard represents Trangia's brand values and overall emotion through a combination of images of their stove system, Swedish nature and moments.

Figure 3.3: Moodboard made for Trangia. Note. Photographs used from Trangia's press kit (Trangia AB, n.d.-b), with the exception of photograph in bottom left (Svenska Turistföreningen, n.d.) and cast iron circle (Tohamina, n.d.).

3.2.2 Product analysis

This section evaluates Trangia's current product catalog. By analyzing recurring design elements, preferred materials, and manufacturing processes, clear design boundaries are established for the new product.

Product Range

Trangia offers several core products, but the modular nature of most of them leads to many permutations. For example, for the Trangia 25 stove, the two windshield parts can come in 4 different coatings, and the 3 different cookware pieces can also come in 4 different coatings or materials. Then the same stove can be used with either gel, gas, or a spirit burner. Then you can select the kettle as part of the stove as well. This already yields 576 distinct permutations. Some of these permutations are sold as "versions"; for example, the "Trangia Stove 25-1 HA" that comes with all parts hard anodised. See Fig. 3.4 for the stove's different parts and material selection.

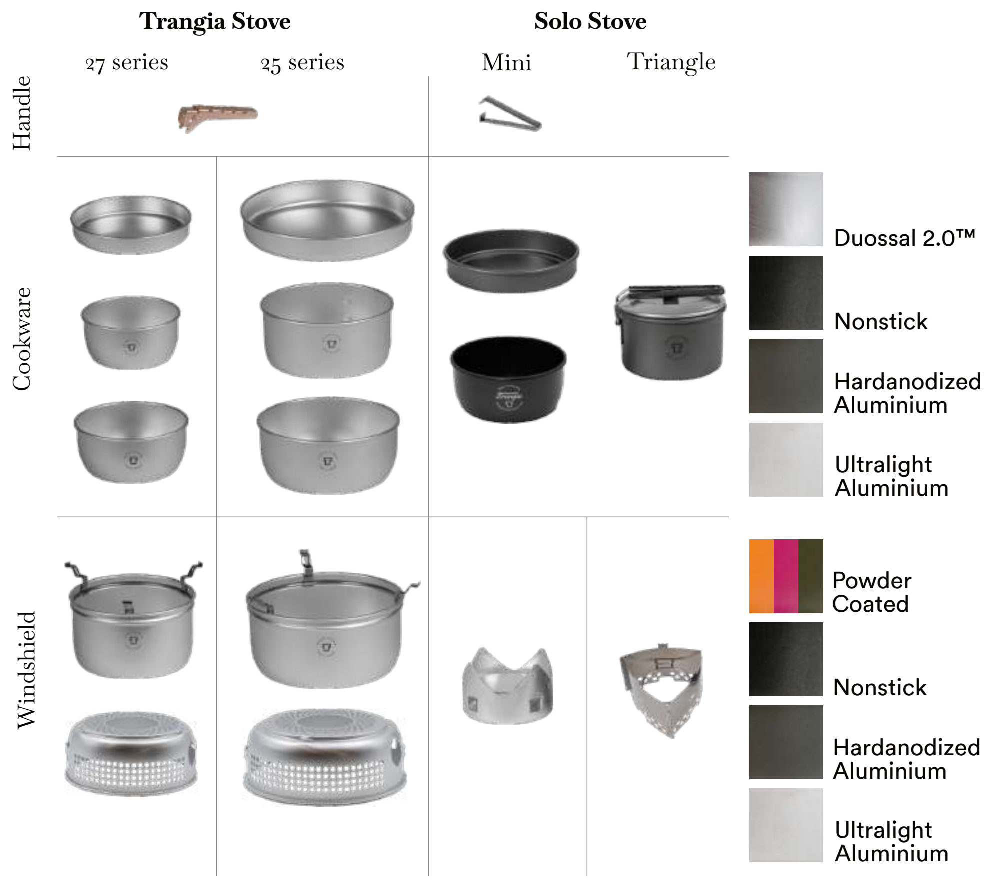


Figure 3.4: Trangia's assortment of camping stoves

Trangia also has a wide range of accessories for its products. These products often come in only one configuration and offer less customisation than the stoves. The manufacturing of the accessories is more often outsourced, or partially outsourced, than stoves, where all parts are made in-house. See Fig. 3.5 for a selection of accessories. These findings are especially important for the future development of a product most likely to be in the class of accessories.

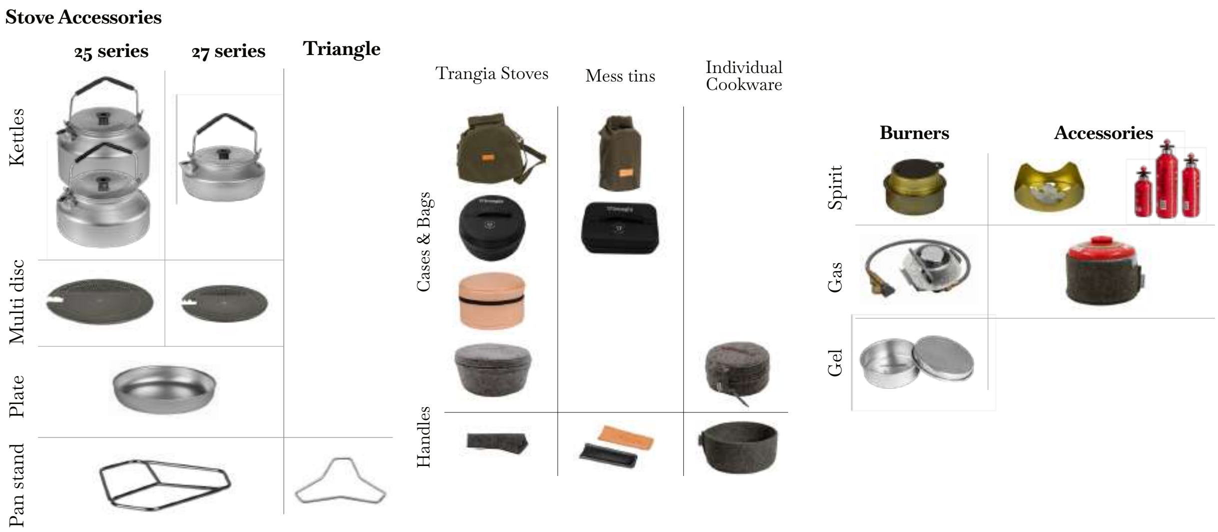


Figure 3.5: Accessories and burners for camping stoves

Design Format Analysis

The design format analysis resulted in a list of recurring design elements or characteristics and the strength with which they occurred in the chosen assortment of products. Below are the four elements with the highest score.

Thin walls is the most strongly recurring design element according to the DFA. Whether a result of the preferred manufacturing techniques or a stylistic choice is debatable, but it is nonetheless a sign of Trangia products. To fit the current product range and overall design language, the developed product should adhere to this design characteristic.

Honest finish relates to not hiding manufacturing traces or imitating materials, but rather displaying them openly in the product design. There is no fake leather, wood veneer or metal-coloured plastic in Trangia products.

Visible construction follows the same honest philosophy as the previous design characteristic. Most Trangia products wear their construction on their sleeve, meaning no rivets are hidden and traces from metal forming are embraced.

Geometrical shapes of relatively low complexity can be used to model most of Trangia's products. There are next to no products with purposefully organic shapes. Instead, most are based on cylindrical volumes.

Ultimately, all design format aspects are relevant and will guide the aesthetics of the final product. In keeping with Trangia's form-from-function design language, the presence of each characteristic will largely depend on the materials and construction required to produce a well-functioning product.

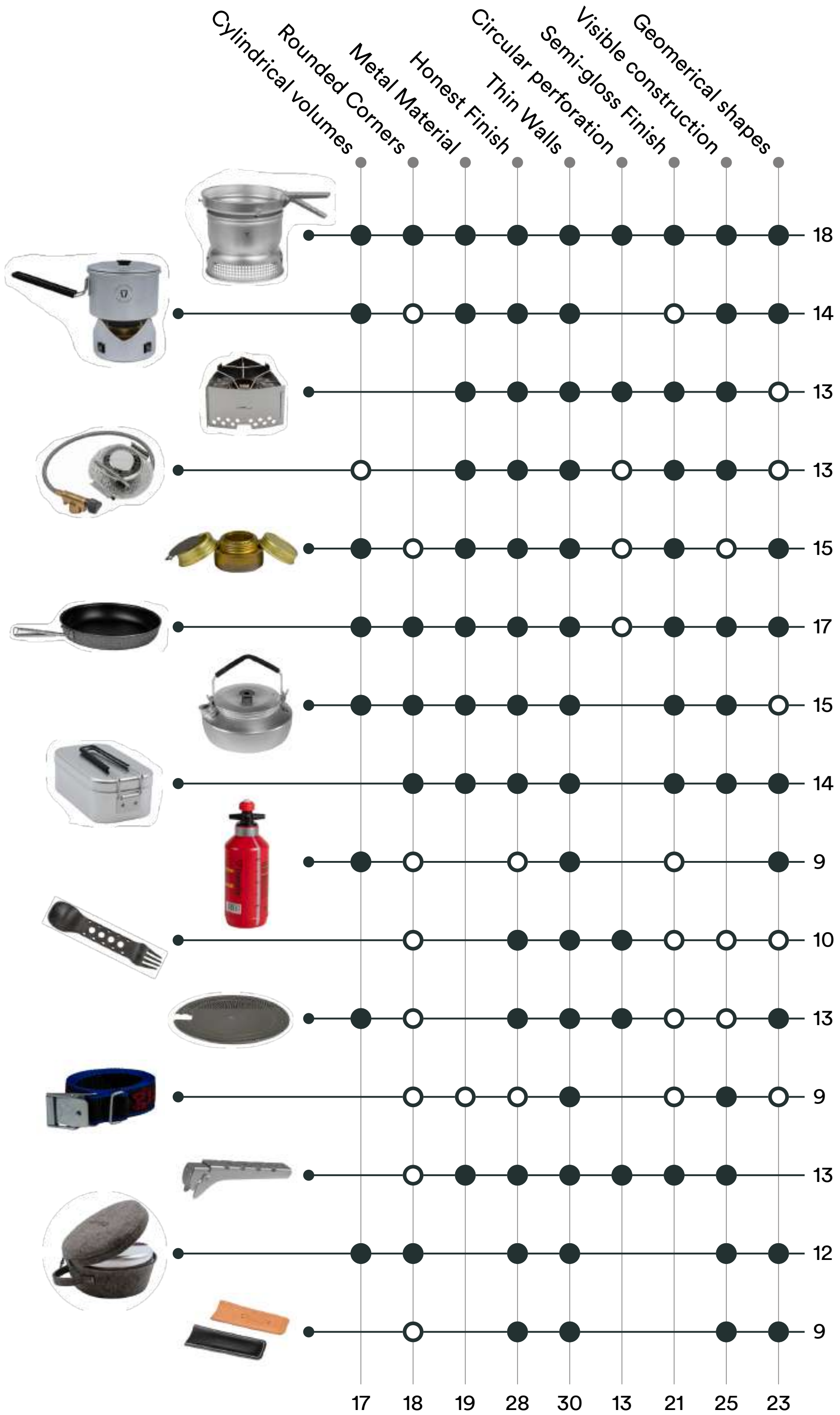


Figure 3.6: Design Format Analysis applied on a selection of Trangia's products. 0 - no circle, no relation. 1 - hollow circle, weak relation. 2 - filled circle, strong relation. Note. Adapted from (Warell, 2001)

Materials and Coatings

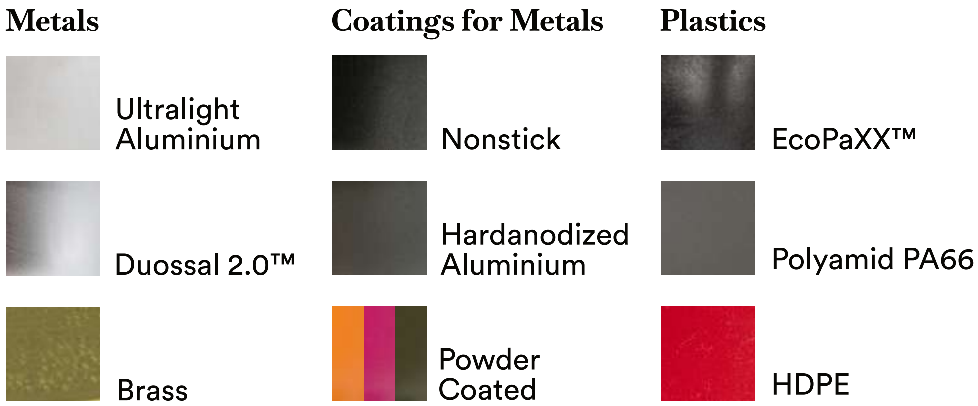


Figure 3.7: The main materials and coatings used by Trangia

Metals

Trangia uses aluminium as the main material in their camping stoves and cookware. Another key material is brass, which is mainly used in the spirit burner. These two materials form the core of Trangia's product range and heritage.
Trangia also manufactures cookware in their laminate material Duossal 2.0™, which has an outer layer of aluminium and an inner layer of stainless steel.

Coatings for Metals

There are three types of coatings used in cooking stove systems. To prevent sticking and facilitate cleaning, a nonstick PTFE coating is available primarily for pans and pots. This coating adds some extra weight, can be sensitive to scraping, and is therefore best used with plastic or wooden cooking tools.

Hard anodising, on the other hand, provides a hard, scratch-resistant surface that is as light as the uncoated aluminium but easier to clean.

Launched recently in conjunction with their centenary, Trangia also offers the upper and lower windshields with a powder-coated finish in three colours: Cloudberry, Northern Pine, and Power Pink.

Plastics

Although Trangia's products are mostly made of metal, some accessories and details of the main products are made of plastic. Excluding fabrics, the plastic materials include the following thermoplastics: Polyamide PA66, High-density Polyethene, and EcoPaXX™ - "[...]a high-performance polyamide with 70% bio-based content derived from the castor plant[...]"(Trangia AB, n.d.-a).

Manufacturing methods

Sheet metal forming and cutting is Trangia's core process. Almost all metal parts manufactured by Trangia are sheet metal parts. One of the most important sheet metal processes for Trangia products is shallow drawing. A shallow drawing converts a flat aluminium sheet into a pot, which is used in the manufacture of both cookware and campstoves. This is achieved by pressing the sheet metal between a punch and a die to draw it out of its plane, forming it to the space between the punch and die (see left side of Fig. 3.8).
To remove the sharp corners of the sheet metal, metal spinning is used to bend the corner in on itself, creating a hem. Metal spinning involves spinning the round material, and a tool gradually moves it into its desired position by plastic deformation (see centre of Fig. 3.8).
To remove material or cut it to the right shape, stamping is used, in which a punch cuts through the material, separating the parts (see right side of Fig. 3.8).

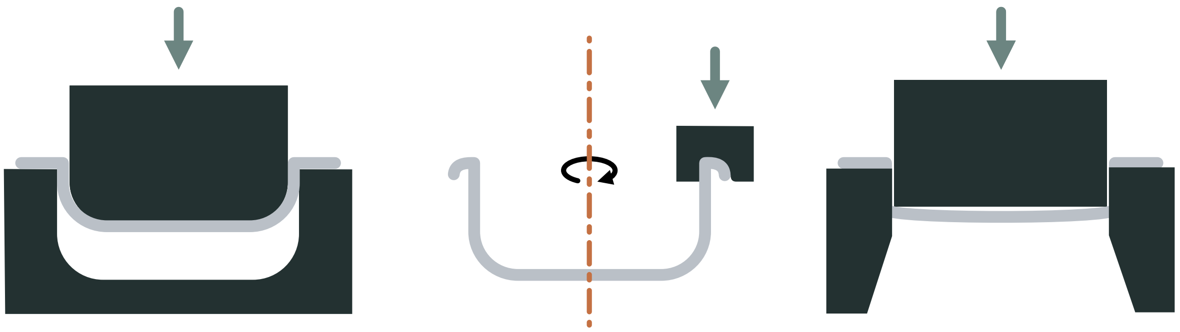


Figure 3.8: Simplified diagrams showing a cross-section of three sheet metal manufacturing methods. Left: A pot created by shallow drawing. Centre: A hem created by metal spinning. Right: A hole created by stamping

Trangia's plastic parts are mostly made by injection moulding. Injection moulding creates the part by injecting molten plastic into the mould, where it solidifies and can later be removed.

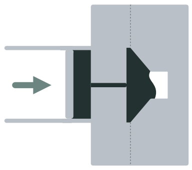


Figure 3.9: A simplified diagram showing a cross-section of a plastic part being moulded by injection moulding

3.2.3 Mission statement

To summarise the findings and guide further work, a mission statement was produced summarising the key takeaways. The mission statement serves both as a communication tool and a decision-making tool, guiding future decisions.
The mission statement:

> To develop a user-friendly coffee brewing solution that enriches the outdoor experience by uniting contemporary brewing habits with Trangia's heritage of sustainability, simplicity, durability, and timeless system compatibility.

To get more specific takeaways, the mission statement method proposed by Ulrich, Eppinger, and Yang in "Product design and development" was used. This provides a more in-depth mission statement that covers more parts of the process; see Table 3.1.

Table 3.1: The mission statement using the methodology proposed by (Ulrich et al., 2020)

Product Description	A specialized accessory or system that allows for contemporary brewing methods of coffee. It integrates seamlessly with existing Trangia storm cooker sets.
Benefit Proposition	**Elevated Experience: Brings contemporary, high-quality brewing standards to the campsite, replacing instant coffee with a genuine ritual.** **System Integration: Integrates with existing Trangia cooking solutions in a seamless manner.** **Reliability: A brewing method simple and durable enough to withstand the same harsh conditions as the storm cooker itself.**
Key Business Goals	Create a product that appeals to the modern "coffee culture" demographic. Maintain the core brand values of Trangia (longevity, repairability, function). Ensure the solution is manufacturable within Trangia's existing capabilities or partner networks.
Primary Market	User group "Providers" as described in Section 5.2.2.
Secondary Market	User group "Ritualists" as described in Section 5.2.2.
Assumptions and Constraints	Compatibility: Must fit inside or work with all or most Trangia cooking systems Durability: Must withstand the same harsh conditions as the storm cooker itself. Simplicity: Minimal moving parts; easy to clean in the field. Sustainability: Product should align with environmental standards similar to Trangia's current products.
Stakeholders	See stakeholder chapter

4

Evaluation of Outdoor Brewing Solutions

Understanding the existing market is crucial for identifying areas of opportunity. This chapter details the benchmarking of current outdoor coffee brewers and the insights gained from testing selected competitor products in real-world conditions.

4.1 Methods

This section outlines the approaches used to evaluate the market. It includes benchmarking to map competitor products, as well as practical field testing to assess real-world usability and performance.

4.1.1 Benchmarking

To understand the current market situation, benchmarking was performed to identify and evaluate competitors' products.
Products were identified by first identifying existing aggregate reviews comparing multiple products. This review resulted in a strong market entry, including an understanding of which existing product types were prominent. Then a broader search was conducted to find even more products, through browsing, searching, and reviewing larger retailers' product assortments.
The scoring categories were influenced by those in the aggregate reviews, but some points were modified and new ones added to fit the specific context.
The scoring weights were designed to reflect the values of the persona groups "The Ritualists" and "The Providers" (see Fig. 4.1). The score was then calculated as a weighted average.
The different variables were plotted against each other to find correlations and trends. Correlations were also used to validate the scoring, as some values, such as weight and portability, for example, should reasonably be correlated.
The aggregate reviews used were from REI and GearLab (Pagador Briseida & Krass Lily, 2025) (Witlacil Mary, 2025)

Criteria	Group cooking	Portability	Ease of Use	Brewing Speed	Ease of Cleaning	Flavour (based on coffee habits)	Waste
Weight	6	4	8	3	4	6	5

Figure 4.1: Weighting for criteria used in benchmarking.

4.1.2 Product tests

Three competitor products were tested alongside Trangia's current coffee solution, Cowboy Coffee. The products to test were selected by choosing the three highest-ranking products from the benchmark. Products that were similar to each other were excluded, so the selection represented three distinct brewing methods.
The test consisted of brewing coffee with each product, noting the process and any comments. This was then converted into a flow in which the different steps were outlined, and the experience of each was evaluated and commented on (see Fig. 4.2). Testing competitor products was done to better understand the current solution and its strengths and weaknesses. The products also serve as inspiration for further design work, with their construction available for reference.

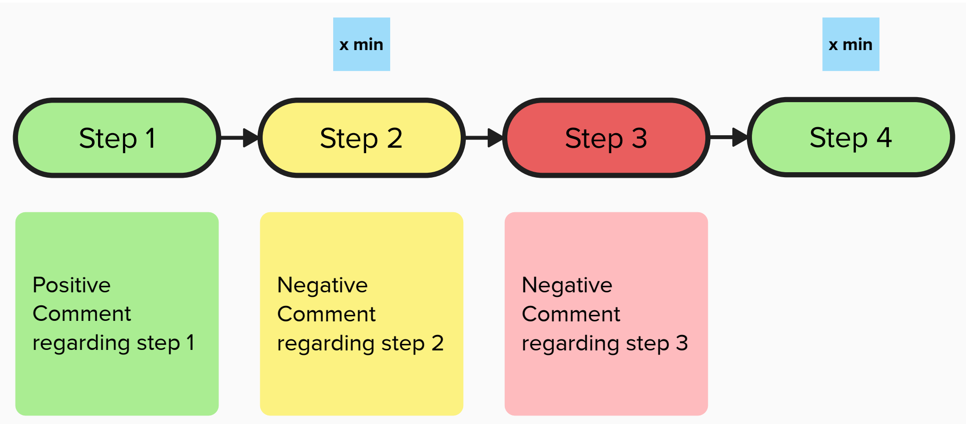


Figure 4.2: Example on how the flows were constructed for each product tested.

4.2 Results

Here, the outcomes of the market analysis are presented. It covers the quantitative data from benchmarking correlations and qualitative insights from hands-on testing of competitor products.

4.2.1 Benchmarking results

The only real trade-off curve observed in the criteria was between group cooking and portability (see left side of Fig. 4.3). For a product to be good for group cooking, it needs to make a large quantity of coffee, which increases its size. This is often because all the brewed coffee must be in a single container, resulting in a larger final product. To break away from this trend, a product must be capable of brewing a large volume of coffee without retaining a large physical footprint. Therefore, the container must either shrink when not in use or be eliminated entirely.

No real gaps were found in the graphs, which indicates that the market is somewhat saturated with existing products in terms of functionality. The takeaway here is that it will be more important to compete on appealing aesthetics and reliability than on raw performance.

The price correlation with the score is interesting. The score and price show a weak downward trend (see left side of Fig. 4.4), indicating that more expensive products are slightly worse than cheaper ones. In general, the price correlates with the weight (see right side of Fig. 4.4). More weight is inherently undesirable for outdoor gear, but it also makes the products more complex and not necessarily more capable of brewing coffee, which generally does not require high levels of mechanical complexity. Simplicity seems to be key in both weight reduction and price reduction.

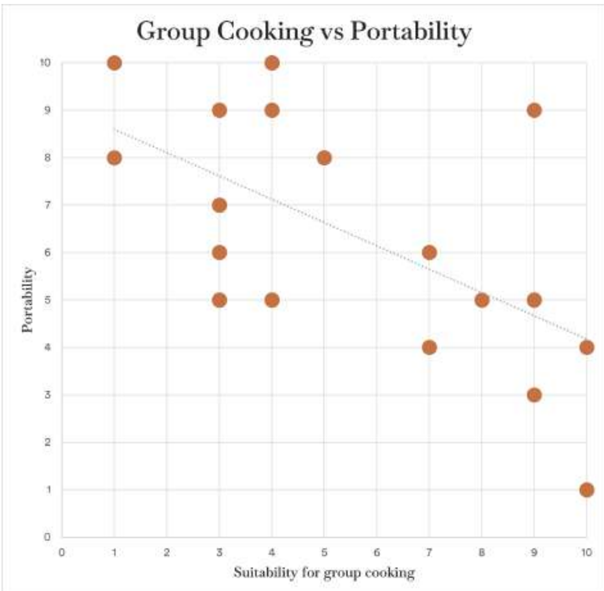


Figure 4.3: Scatter charts of outdoor brewing solutions. X-axis: group cooking, Y-axis: Portability

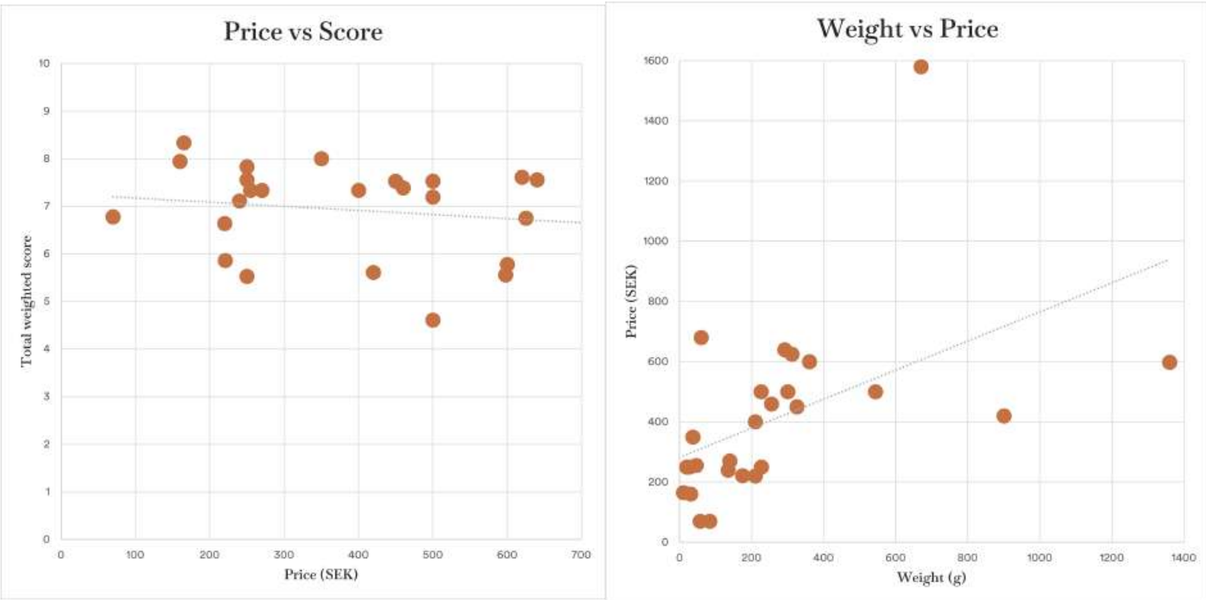


Figure 4.4: Scatter charts of outdoor brewing solutions. Left side: price on the X-axis and score on the Y-axis. Right side: weight on the X-axis and Price on the Y-axis

4.2.2 Product tests

The selected products were: ”GSI Ultralight Java Drip”, ”Mug Mate”, a small French press, and cowboy coffee, as shown in Fig. 4.5. Thereby, the testing covered the following brewing techniques: pour-over, immersion, French press, and cowboy coffee. The test was conducted during late winter, with temperatures around -8°C and wind chill down to -17°C (see Fig. 4.6.)

Figure 4.5: GSI Ultralight Java Drip, Mug Mate, and Cowboy Coffee being tested.

Figure 4.6: Picture of overall product testing environment, with French press being tested.

The main insight gained from the test was the balance of user engagement. Products with long wait times during which nothing seemed to happen were perceived as boring and slow, while those that required constant attention were deemed annoying and time-consuming. A middle ground would then be better, with a solution that requires low attention but offers a more visually and experientially stimulating process.
Cleaning the products was also complicated because the coffee grounds stuck to the mesh filters, making them difficult to clean. The more mesh a product had, the more difficult it was to clean. For example, the GSI Ultralight Java Drip, which consists almost entirely of a fine filter, was very difficult to clean without the user getting coffee grounds and water on their gloves, as shown in Fig. 4.7

Figure 4.7: Cleaning the GSI Ultralight Java Drip with water, attempting to collect coffee grounds in a container.

The cold weather greatly affected all parts of the processes. Especially when using the product with mittens and cleaning it. Some brewing methods also do not produce warm coffee in this more "extreme" environment.
See the full results of all the tested products in the appendix Fig. A.1.

5

Identifying User Needs

A successful product must solve actual user problems. This chapter details the process of identifying key stakeholders, gathering qualitative and quantitative user data, and translating those insights into a concrete requirement specification.

5.1 Methods

This section describes the multi-faceted approach used to gather user data, ranging from stakeholder mapping and persona creation to interviews, observations, and surveys.

5.1.1 Stakeholders

As a basis for identifying user needs, a stakeholder map was created, informed by preliminary studies and discussions. The project's stakeholders were mapped out to determine who is affected by the product and what methods might be appropriate for understanding their needs. These methods were selected based on each stakeholder's estimated involvement with the product. The most involved stakeholders were assigned high-resolution, high-effort methods, while less critical stakeholders were assigned less demanding methods for identifying user needs.

5.1.2 Tentative Personas

Based on discussions within the project group and basic information about Trangia's view of its customer base, personas were created with assumed backgrounds, attributes, and needs. The personas were conceptualised based on target market archetypes from discussions with Trangia AB and secondary research in the outdoor industry, providing a tentative map of users. To create images that realistically represented the personas, Generative AI was used (Google, 2026).
Although the personas were based on assumptions, they provided a solid framework for exploring user differences and later enabled the grouping of interview participants during data analysis. The personas' level of detail, although primarily conceptual,

helped the project group empathise with and relate to the imaginary users during product development, thereby aiding decision-making.

5.1.3 Participant sampling

Table 5.1: Summary of participants in interviews and observations.

ID	Residence	Gender	Age	Experience	Format	Time (min)	Persona grouping
1	Sweden	F	25	Outdoors shop worker	Interview	25	-
2	Australia	M	40	Outdoors content creator	Interview	35	The Providers
3	Sweden	F	30	Frequently outdoors, barista	Interview	30	The Providers
4	Sweden	F	25	Casual outdoors	Observation + Interview	100	The Providers
5	Sweden	F	40	Casual outdoors	Observation + Interview	50	The Providers
6	Sweden	M	50	Outdoors content creator	Interview	40	The Ritualists
7	Sweden	M	50	Outdoors content creator	Interview	35	The Ritualists
8	Sweden	M	25	Frequently outdoors	Interview	35	The Ritualists
9	Sweden	M	25	Frequently outdoors, scout	Observation + Interview	25	The Ritualists
10	Sweden	M	25	Frequently outdoors	Observation + Interview	100	The Ritualists
11	USA	M	30	Outdoors content creator	Interview	35	The Spec hunters

In total, 535 minutes of user interviews and observations were conducted. To obtain user needs data that covers most potential users, people of different ages and genders were approached. As ”The Providers” and ”The Ritualists” were deemed suitable target user groups for the product, participants with backgrounds and attributes similar to those of these persona groups were prioritised for participation.
Overall, the selection of participants can be described as purposive convenience sampling (Denscombe, 2010). Individuals with certain characteristics (roughly matching the defined persona groups) were contacted to participate. However, the number of participants from different groups largely depended on convenience and, to some extent, response rates.

Lead users

To extract the latent needs of regular users, lead users with a certain interest in coffee and outdoor gear were also interviewed. For the gear-perspective, content creators with YouTube channels that focus on the outdoors and gear for it were contacted. To capture the coffee-enthusiast perspective, a person who had previously worked as a barista for several years was also interviewed.

Distributors

To gain insights from the perspective of distributors (retail stores), one employee at a popular outdoor store in Sweden was interviewed. To complement this one-person perspective and to gain first-hand insight into which coffee accessories are available and popular in physical stores, three outdoor stores were analysed throughout the project. The store layout and product range were observed in an unstructured, explorative manner, and at each store, an employee was asked to help find a good solution for brewing coffee outdoors.

Manufacturing

Trangia's manufacturing was explored in two different ways. Firstly, a semi-structured online interview was conducted with a production manager at Trangia, during which manufacturing capabilities, constraints and preferences were discussed. Secondly, Trangia's manufacturing facility in Trångsviken was visited, and a tour was given.

5.1.4 Interviews

All interviews were conducted in a semi-structured manner, meaning predetermined interview structures were prepared but not strictly adhered to, allowing for steering the conversation without restricting exploration in the early stages. In total, four interview structures were created and adapted to capture the perspectives of the primary users, the production manager, retail store workers, and baristas. As interviews with primary users were held, the structures were iteratively refined to optimise duration and focus. Interviews were selected to obtain first-hand qualitative data from users and other high-priority stakeholders.

5.1.5 Observations

The observations were direct and obtrusive, consisting of user tests in which participants tried different outdoor coffee-brewing solutions and answered questions about them. In total, four different products were tested: the MSR Mugmate, GSI Ultralight Java Drip, Primus Coffee and Tea Press, and Trangia Cowboy Coffee. For more information about the products, see Section 4.2.2. Participants were asked to discuss their thought processes while using the different products. After testing the products, the experiences were discussed, supported by scales (see Fig. A.5), which the participants used to express their opinions on different aspects of the products.

Figure 5.1: Photo of testing environment for one of the observations.

The observations were conducted in near-natural environments in parks, both on the ground and on benches, as shown in Fig. 5.1. The environment was similar to the real-use environment in terms of location and physical layout, but inevitably differed in context, as the purpose of the brewing was to test different coffee-brewing products.

Observation was used to gain a deeper understanding of the user and context, and to identify pain points in using the current products. The method also theoretically enables the identification of latent needs which the user does not express but which can be observed.

5.1.6 Quantitative data gathering

All interview and observation representatives participated in a brief Likert-scale survey on key attributes of an outdoor coffee-brewing product. The Likert-scale consisted of judging an attribute of a coffee brewing product from ”Completely irrelevant” to ”Very important” (Koo & Yang, 2025).

The survey consisted of nine attributes (see Fig. 5.2), based on earlier criteria used in aggregate market research reviews (see Section 4.1.1), as well as Trangia's brand values (see Section 3.2.1). To answer, a mark was placed on each scale, resulting in an answer from 1 to 5 for each attribute.

Likert scale results were used to provide guidelines on which attributes are valued more than others. This provides clear instructions for future design work, where compromises between attributes are inevitably required. The Likert scales also worked as guiding points of discussion in the semi-structured interviews.

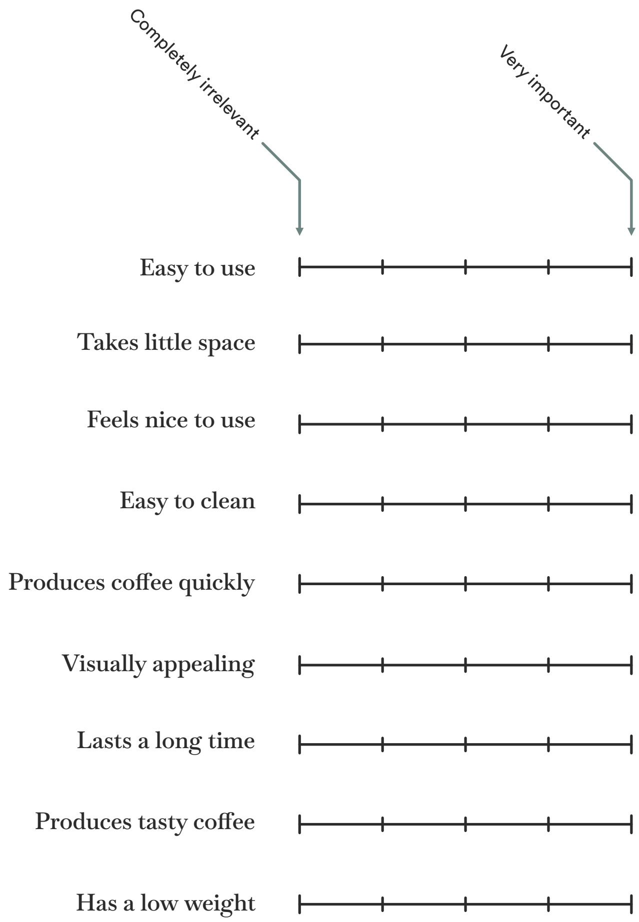


Figure 5.2: The Likert scale used in the survey.

5.1.7 Qualitative data analysis

To convert the raw user data gathered during the interviews and observations into a more refined, interpretable state, a KJ analysis was made. Firstly, all recordings from the interviews and observations were transcribed. These texts were then analysed carefully, and quotes indicating a need, behaviour, or other statements relevant to the project were extracted and recorded as direct quotes or, for longer quotes, as summaries. As part of the KJ analysis, these quotes were iteratively grouped into clusters from which user needs emerged. (Plain, 2007).
The KJ method was selected for its ease of handling large amounts of data quickly and for its clarity in identifying what users value.

As the user data came from many different participants with varying backgrounds and attributes, retaining the source of each quote was important to facilitate discussion when grouping and interpreting the statements. To indicate data origin, the statements were colour-coded by the interview or observation from which they were gathered.

Many of the included quotes clearly contradict one another. To signal these disagreements among interview participants, a lightning icon was placed between opposing clusters. This provided nuance and clarity when interpreting clusters and transferring their message into the user needs list. For the complete KJ-Analysis board, see Appendix Fig. A.3.

5.1.8 User Needs list

The KJ analysis groups were further interpreted into concrete interpreted user needs. The needs were stated as desired product properties, for example: "Produces warm coffee". The needs were then evaluated to determine if they were "demands" or "wishes". The relevant main and secondary stakeholders were also noted for each need. Lastly, the needs were categorised according to their relationships with other needs (see Table 5.2).
Formulating the user needs reinforces understanding of the user's relationship with the product and helps inform the development of a requirements specification.

Table 5.2: Example of how the user needs were categorised

Need	Type:	Category	Main Stakeholder	Secondary Stakeholder
Example need 1	Demand	Category 1	Stakeholder 1	Stakeholder 2
Example need 2	Wish	Category 2	Stakeholder 1	Stakeholder 3
...				

5.1.9 Requirement specification

To address stakeholder demands and wishes not captured in the user needs list, and to provide a structured checklist for assessing concept validity, a requirements specification was created. With the support of the user needs list and information gathered in pre-studies, verifiable, concrete criteria were established for the product. The criteria were stated as product properties with relevant target values, for example: "Finished coffee temperature > 60°C". Each requirement also has a verification method, for example: "Thermometer" (see Table 5.3).

Table 5.3: Example on how the requirements can be stated

Criteria		Target values	D/W	Verification method
1.1	Max brewing time	<15 min	D	Time Measurement
1.2	Weight of product	<500g	D	CAD Weight Measurement
...				

5.2 Results

The findings from the user studies are presented in this section. It introduces the defined target groups, interprets the collected interview data, and concludes with a finalised list of user needs and a requirements specification.

5.2.1 Stakeholders / planning

The stakeholder map, shown in Fig. 5.3, lists all stakeholders who might be affected by the project and the product to be developed or who might hold insights valuable to the project. The coloured boxes to the right of each stakeholder category indicate which methods were chosen to understand their respective needs and the environment in which they would be implemented. Some stakeholder categories have several methods and environments listed, because multiple methods were used.

The stakeholders whose needs were deemed critical to project success were the product's primary and secondary users. Hence, a large emphasis was placed on gaining a deep, holistic understanding of this group. Methods employed to elicit their needs include both constructed interviews and natural observations, complemented by interviews in the same environment.

Product distributors, lead users and people involved in manufacturing have relevant needs and insights, but the depth of analysis required to gain a sufficient understanding of their needs was lower. Therefore, quicker, less demanding methods were applied.

For project-focused stakeholders, people in the product's surroundings and second-hand buyers of the product, assumptions, discussion and common knowledge were deemed sufficient methods for understanding stakeholder needs. Other, more technical demands were examined through literature studies.

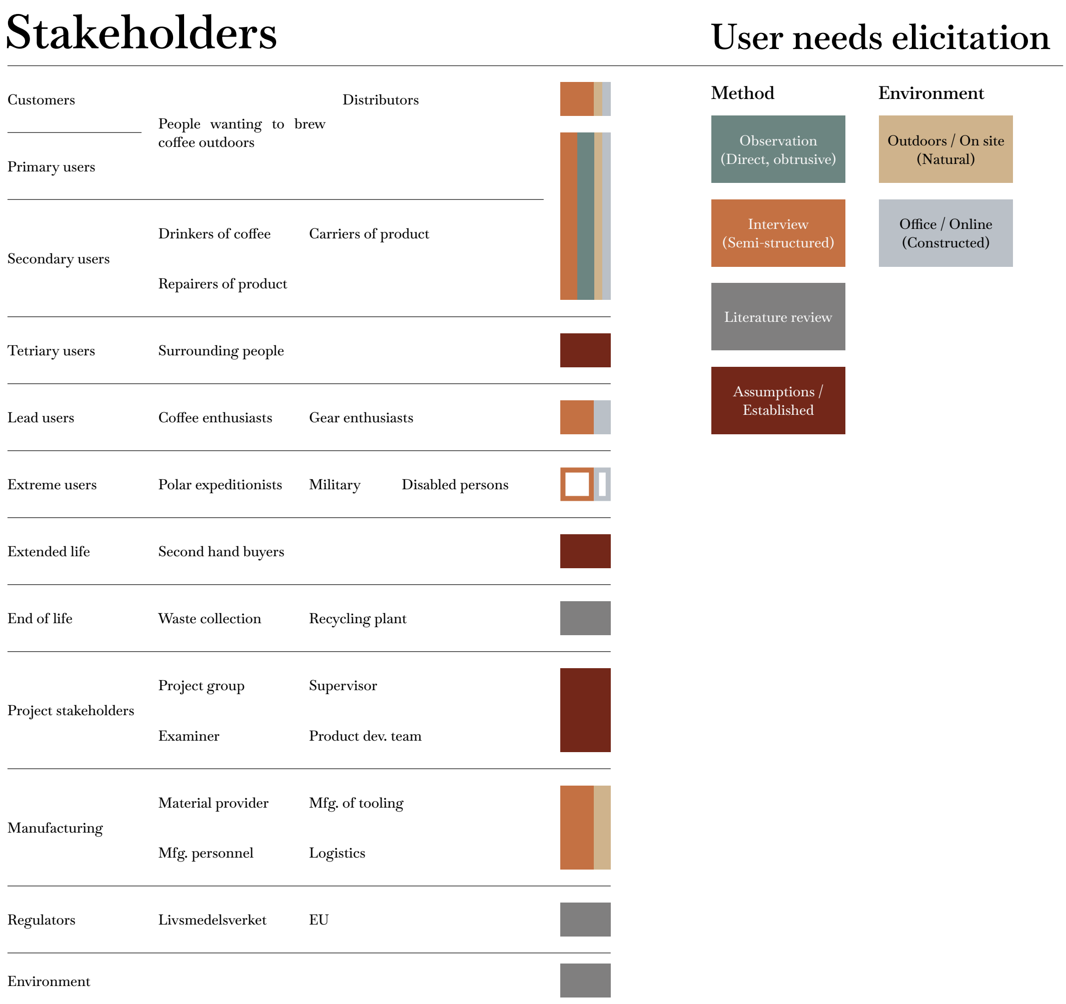


Figure 5.3: Stakeholder map listing all relevant stakeholders and the methods chosen to elicit their respective needs. Hollow boxes indicate methods which ultimately were not used.

5.2.2 Tentative Personas

To create a tentative map of the potential primary users of the product and their differences, six personas were created that cover a range of different user types. The created personas, along with their respective needs, are displayed in Fig. A.2.

In discussions about personas, two central metrics for the user's relationship with the product were identified: interest in coffee and interest in the outdoors. All six personas were mapped according to their interests in the respective fields, as shown in Fig. 5.4. Later, this was used to discuss and position concepts in relation to the personas, as shown in Chapter 8

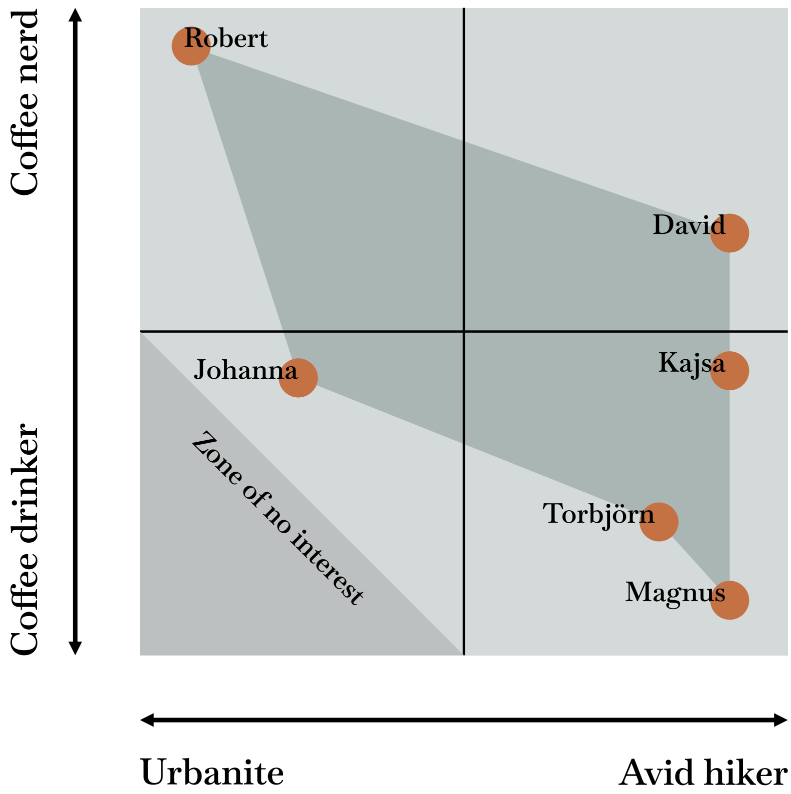


Figure 5.4: Personas mapped based on their interest in coffee and the outdoors, respectively.

Based on shared attributes and needs, the established personas were categorised into three distinct groups, which are illustrated in Fig. 5.5. The grouping makes it easier to relate to theoretical user types. By connecting Trangia's values, as defined in Section 3.2.1, with the values of the various persona groups, distinct user segments emerge, each characterised by specific values and interests, as described below.

Figure 5.5: Three user groups based on personas along with their members and the Trangia values they align most closely with. Profile images generated using generative AI (Google, 2026).

The Providers view the outdoors as a space for moments together. They carry responsibility for others, which demands gear that is reliable, safe, and capable of producing larger volumes of coffee. It must also withstand the chaos that kids or scouts may create. Although Johanna and Magnus have slightly different outlooks on the importance of taste in their coffee experience, utility and safety are a clear common ground for them.

Given the strong emphasis Trangia places on safety and reliability in its products, Providers are a key user group for Trangia's offerings. Focusing on this group also aligns with their purpose of getting more people outside, as this group make up a relatively large market segment.

The Ritualists value the experience of being in nature highly. They embrace the meditative aspects of outdoor activities and view the outdoor brewing experience as part of the journey - not something to be rushed for a caffeine-kick. To this group, efficiency is not the focus, but a sustainable and straightforward solution that has stood the test of time. The feeling of the brewing process is much more important than how light the gear is or how smooth the coffee is.

This user group aligns well with Trangia's values of tradition and sustainability. It is likely that a member of this user group already owns and enjoys Trangia products.

The Spec Hunters represent boundary pushers in their own right, constantly seeking improvements and new, exciting solutions. While Robert is looking for new ways to enhance the coffee experience, David is exploring how minimalist he can make his hiking setup without sacrificing major functionality. Although their goals are ultimately different, their core driver is the same - optimisation.

As this user group is looking for unique, high-tech, and precise gear, they directly challenge Trangia's values of tradition, accessibility, and the ”reliability through simplicity” ethos.

Conclusion

The Ritualists represent the core user group for Trangia as a whole, as their appreciation for tradition and the slow, ”enjoy the moment”-approach aligns with Trangia's brand identity. Although the Spec Hunters do not align with Trangia as a brand, they represent lead users in their respective fields, and their insights may help identify latent user needs and inspire development. The Providers represent a less niche,

broader group of people, whose needs can be met by Trangia without straying away from the soul of the brand.
In conclusion, the Providers are deemed the most promising user group to emphasize in the product development project, closely followed by the Ritualists, whose needs more or less represent Trangia as a brand. A brewing solution that fulfills the needs of both user groups will make nature moments more accessible while honoring Trangia's heritage. The Spec Hunters remain potential but unlikely customers that might inspire new development.

5.2.3 Interviews and Observations

During the interviews, it became clear that people generally have strong, differing opinions about coffee and what makes ”good” coffee. Most casual coffee drinkers focus on which brewing process is best, while coffee enthusiasts pay more attention to details in the ”recipe”, such as coffee type, roast, amount, and coarseness. Participants from different (Western) cultures also displayed conflicting views on what ”normal” coffee was; for example, an Australian described drip coffee (the most popular process in Sweden) as something you only see in old American movies. Therefore, the choice of brewing method becomes even more crucial, as it is one of the main factors influencing a potential customer's decision.

The interviews also made it clear that different users' ways of enjoying the outdoors place very different demands on the coffee gear itself and how it is used.

All participants indicated that disposing of coffee grounds directly into the environment was acceptable, provided it was done discreetly and was not visible later. There was no direct need to provide storage for spent coffee grounds. Disposing of paper coffee filters was more involved, with them either burned, buried, or carried home.

During the observation, it became clear that making pour-over coffee for more than one cup was irritating due to the extended pour time (4-8 minutes). It occupied the user's hands at all times, preventing any other task from being completed simultaneously. Compared to the press coffee, where the users complained about waiting for the coffee to steep (4 min). In the case of press coffee, there is no indication that the brewing process is underway, and it is therefore perceived as boring. A solution that does not require direct user input during the brewing process and is still in some way stimulating is ideal. An example of a product that succeeds at this is the Moka pot, which does so with its pleasant sounds and visible steam.

Overall, the observations in outdoor retail stores indicated a varying but relatively low focus on coffee-brewing solutions. The shelves dedicated to the segment were dominated by competitors to Trangia, confirming the company's weak position in the segment.

5.2.4 Quantitative data analysis

The data from the Likert scales were compiled and visualised in Fig. 5.6, which shows the relative importance of each rated aspect. The figure is ordered from the most important mean to the least, and the width of the shaded area indicates the level of confidence with which the rating can be interpreted.

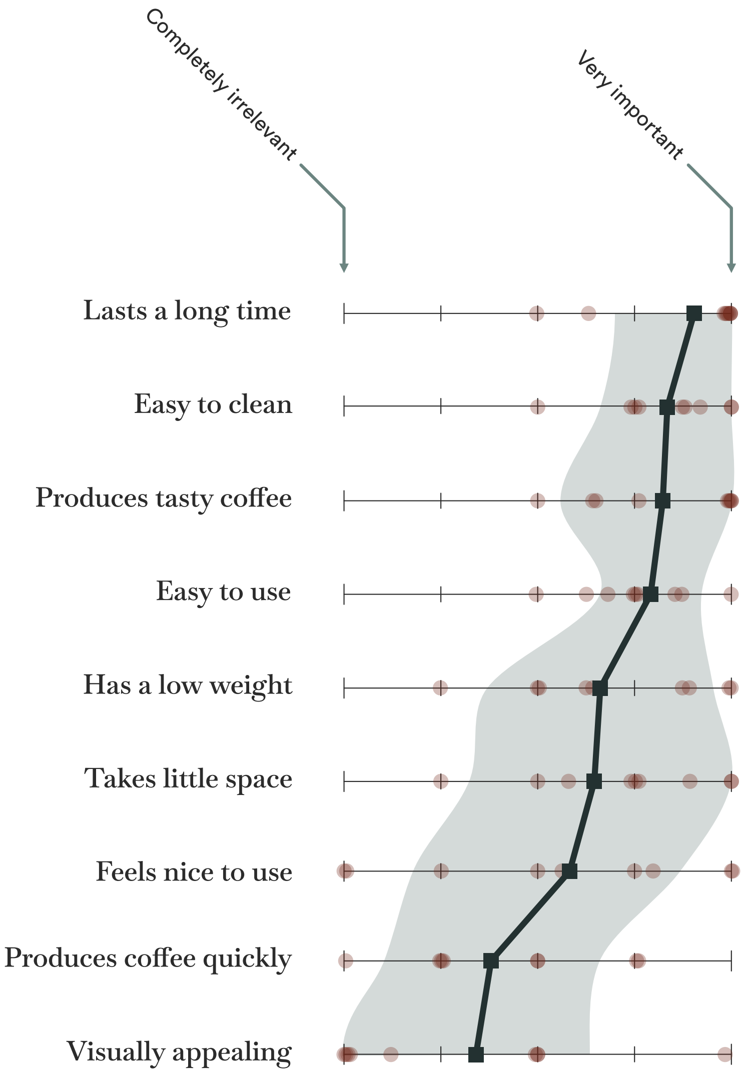


Figure 5.6: Likert scale results. Transparent dots represent participant ratings. Squares represent the mean rating. The shaded area represents one standard deviation on each side of the mean.

As can be concluded with relatively high confidence from the data, longevity, ease of cleaning and use, and the ability to produce a tasty cup of coffee are highly important aspects in creating a successful outdoor brewing solution. Generally, aspects with lower means also had greater response variance. Participants did, however, indicate less concern about the product's aesthetics and brewing speed. These insights could later be used to prioritise user needs and evaluate concepts.

5.2.5 Qualitative data analysis

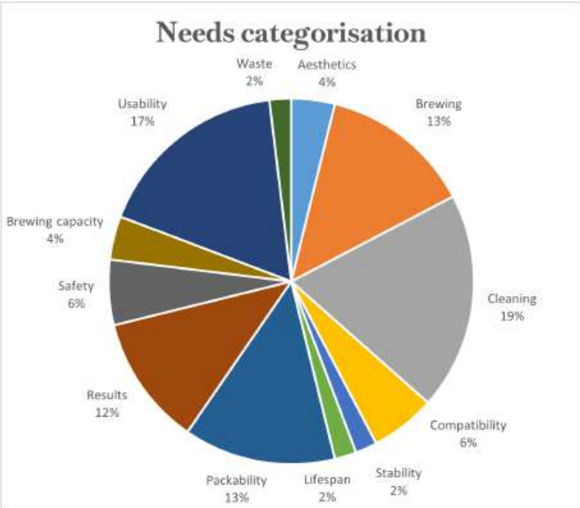
The KJ analysis yielded roughly 60 clusters of statements, each labelled with a header that captured the cluster's essential message, as shown in Fig. A.3. Some of the strongest disagreements observed in the clusters concern central aspects. For example, the importance of the product's weight and volume varies widely across statements and participants. The same goes for brewing time and experience. Comparing the oppositions in the clusters with the Likert-scale visualisation, the data seem to agree: the same themes have relatively wide standard deviations in Fig. 5.6.

Interestingly, many participants make statements that address both sides of opposing statement clusters. This indicates considerable nuance in user needs not only from user to user but also within each individual, depending on the use context and other variables.

5.2.6 User Needs list

Through interpretation of the KJ-analysis clusters, 52 unique user needs were identified and categorised into 36 demands and 16 wishes. The needs were, in turn, divided into 12 main topic-based categories, as illustrated in the left side of Fig. 5.7. Here, it is clear that cleaning, usability, packability, brewing, and results are topics with many associated needs. Although the number of related needs is not directly indicative of relative importance, it provides an overview of which aspects of use are most frequently raised and must be given special consideration when developing the product.

As for what stakeholders are affected by the interpreted needs, primary users are in a clear majority, as these were the main interview participants, followed by secondary users, as shown on the right of Fig. 5.7. As expected, many of the stakeholders considered have no associated needs in the user needs list, indicating that they should be addressed in other ways.



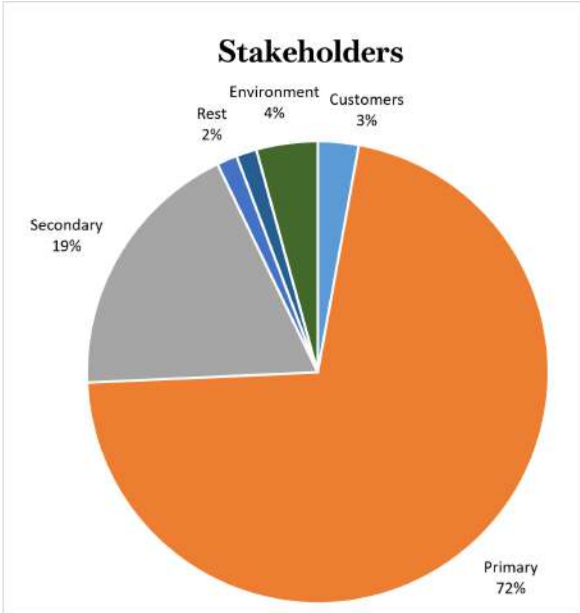


Figure 5.7: Left: Pie chart illustrating distribution of categories in user needs list. Right: Pie chart illustrating the distribution of affected stakeholders in the user needs list.

For the full list of the 52 identified user needs, see Section A.3.

5.2.7 Requirement specification

The requirement specification contains 14 categories of requirements, each containing product requirements classified as either demands or wishes based on their importance. The verification methods range from qualitative analysis to temperature measurements. For the full requirement specification, see Fig. A.4. The categories of requirements are listed below.

1. Performance
2. Environment
3. Coffee
4. Lifetime
5. Cleanability
6. Manufacturing
7. Material Origin
8. Packability
9. Compatibility
10. Trangia's Brand
11. Food Safe
12. Recyclability
13. Ergonomics
14. Safety

6

Preliminary Coffee Brewing Exploration

Before developing full concepts, preliminary explorations were conducted to bridge the gap between user needs and technical functionality. This chapter covers the early brainstorming and research efforts that shaped subsequent ideation.

6.1 Methods

The aim of the early exploration was to gain a clear understanding of the problem through both analytical and creative approaches. The analytical approach ensures a clear understanding of the main function of brewing coffee, while the creative side explores how the user relates to the main function.

6.1.1 Brain drawing

Brain drawing is a semi-structured idea-generation method that aims to generate creative solutions to problems. First, participants sketch on their own paper for about 10 minutes, depending on the topic's depth, then switch papers with their peers and continue sketching on the new paper. This is repeated 2-3 times, and it ends with the solutions being presented and discussed.
Brain drawing was conducted on the central criterion identified during the user studies. This was done to create an understanding of the different needs and how they can be met. In the late stages, some of these solutions were combined to create concepts.

6.1.2 Desk research

To better understand coffee brewing, a literature review was conducted. The aim was to understand which variables affect the final result and how different brewers influence them.
The resulting findings about coffee brewing are presented in the coffee theory section Section 2.1.

6.2 Results

The results of the idea generation were rough sketches showing how different user needs could be met. Examples of resulting sketches regarding cleanability and usability are shown in Fig. 6.1, Fig. 6.2 and Fig. 6.3.

Early exploration of coffee brewing helped shape an understanding of how user needs relate to the coffee-brewing process and to brewers. This understanding was crucial for the next step, when more complex concepts were formulated. As mentioned, the specific coffee knowledge gathered is presented in the theory chapter (see Section 2.1).

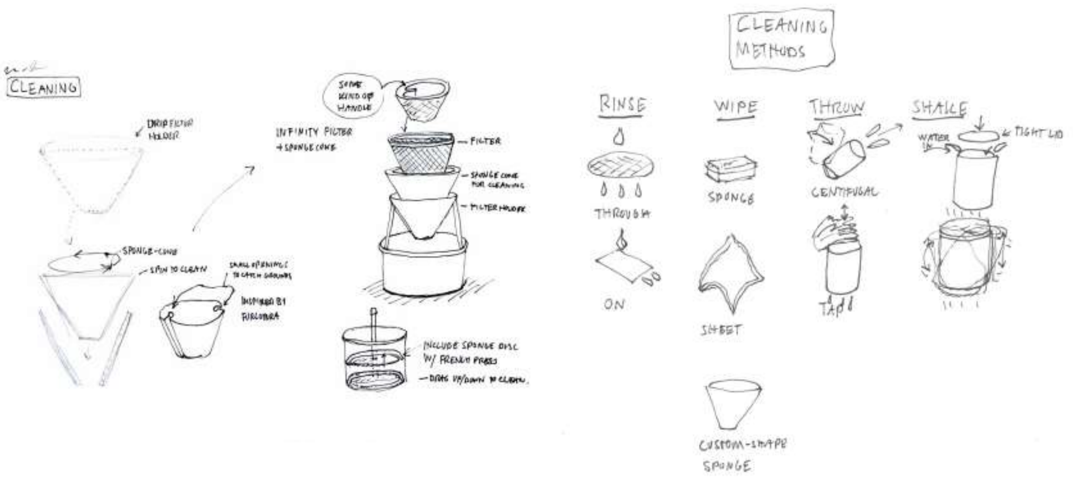


Figure 6.1: Compilation of example sketches related to cleanability

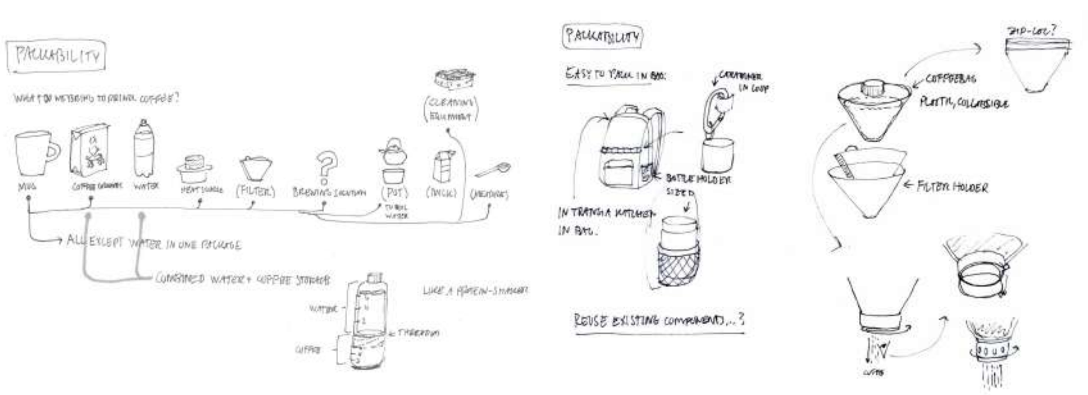


Figure 6.2: Compilation of example sketches related to packability.

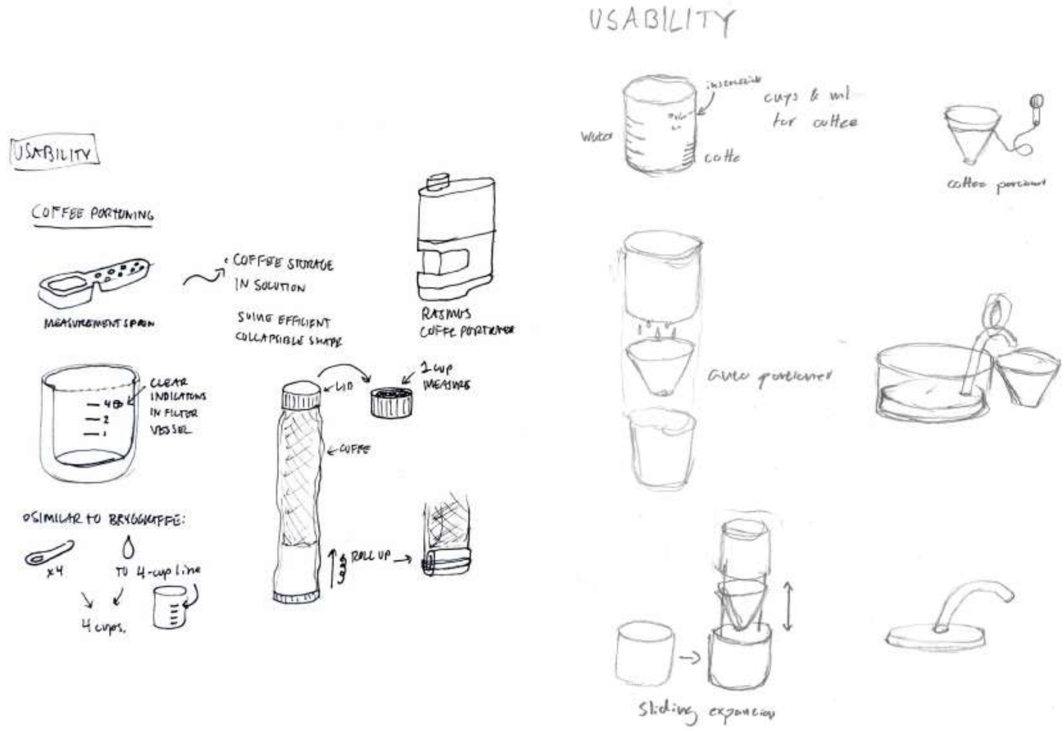


Figure 6.3: Compilation of example sketches related to usability.

7

Exploration of concepts

This chapter details the transition from incoherent solution to sub-problems to product concepts. It covers the structured ideation, rapid prototyping, and iterative elimination processes used to explore and narrow down the vast solution space.

7.1 Methods

This section aims to convert the knowledge and partial concepts from the earlier chapter into more complete concepts that address all stakeholders' needs identified earlier in the process. A big emphasis was placed on exploration and early testing to learn fast in this phase. Hence, the development of concepts consisted largely of studying the overall goal, breaking it into parts, ideating ways to address each part, evaluating the feasibility of these ideas by building and testing them, and then combining the viable solutions into concepts. This was done multiple times at different levels and resolutions to narrow in on promising solutions gradually.

7.1.1 Function/Means Tree

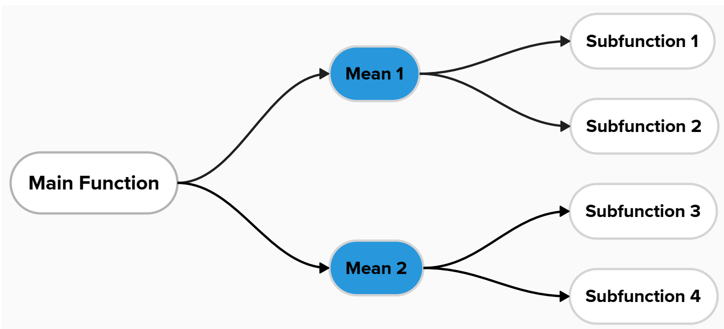


Figure 7.1: Example layout of the function/means tree. Note. Adapted from (Myrup et al., 2015).

The function/means tree (FMT) is a structured concept-generation method that aims to explore as much of the idea space as possible by decomposing the main function into distinct subfunctions. Then, multiple means are ideated for each function. A concept can be generated by selecting a solution for each function. (Myrup et al., 2015) The linear nature of coffee brewing lends itself to being broken down into distinct functions, making FMT ideal for exploring the idea space. FMT also ensures that all the main functions are fulfilled in a concept. In further development of concepts generated through FMT, findings related to cleanability, packability, and other aspects from the earlier idea generation (see Chapter 6) were used.

7.1.2 Sketch-Based Discussion

The most frequently used method to further knowledge and understanding of a problem and its possible solutions was sketch-based discussion. When the group encountered a problem, both group members sketched possible solutions for a set duration, depending on the problem's complexity. When time was up, the sketches were discussed, and, depending on how well the problem had been solved or how large the remaining idea space was believed to be, multiple rounds were conducted. This organic way of generating ideas often followed a more rigid method, in which concepts were revised, modified, and combined.

The group's curiosity is essential for creating an environment that questions fundamental assumptions and explores innovative solutions and concepts. The sketch-based discussions sparked curiosity and often led to new ideas. The physical nature of the sketches also helped document the potential solutions.

7.1.3 Prototyping

To validate subsolutions and enable early discarding of concepts, prototypes were frequently constructed and evaluated throughout the concept development process. The prototyping efforts were mainly focused on experimental solutions, as their validity was often uncertain. As the prototypes were constructed to evaluate subsolutions, only the parts necessary to confirm or refute the solution's validity were built, though the required prototype complexity varied by solution.

One of the identified potential solutions for filtering coffee was ”vacuum filtering”, as described in Section 7.2.1. This method showed promising gains in cleanability and longevity, but it was uncertain whether it could produce good coffee, or coffee at all. Therefore, a more deliberate test of the ”vacuum filter” method was conducted. This test primarily measured the time for the coffee-water mixture to pass through the filter, the coffee's quality and clarity, and the filter type used. To better control the experiments and gain further insight into the results, additional variables were monitored and studied; see Table 7.1.

Table 7.1: Variables used in vacuum filter experiments

Name	Unit	Variable Type
External pressure	Y/N	Input
Coffee	g	Input
Water	g	Input
Water to Coffee Ratio	1:n	Derived
Coffee grounds	name	Input
Temp	°C	Input
Time (dnf: 15+)	min	Output
Liquid result	g	Output
Water in grounds	g	Derived
Water loss	%	Derived
Throughput	ml/s	Derived
Picture of coffee	-	Output
Clarity	Comment	Derived

The bulk of the prototypes were constructed using FDM 3D printing for rapid iterations, repeatability, and dimensional stability. Some parts were constructed out of metal for thermal stability.

7.1.4 Elimination matrix

The elimination matrix is a structured method for assessing the feasibility of concepts and their adherence to criteria. In assessing this project's early concepts, the criteria were based on user needs interpreted from the KJ analysis. To condense the matrix and provide a glanceable structure, the main categories of these interpreted needs, as shown in Fig. 5.7, were listed as headers in the elimination matrix. The concepts were evaluated against these primary criteria, supported by their respective needs in the user needs list, and any that did not meet them were eliminated.

The elimination matrix helps find critical weaknesses in concepts. This can then guide the decision to revise the concepts or eliminate them.
(Pahl Gerhard & Beitz Wolfgang, 2007)

7.1.5 Kesselring matrix

The Kesselring matrix is a more detailed assessment tool for comparing concepts and identifying which are stronger or weaker. It is based on assigning a weighted score to each concept for each criterion. First, each criterion is internally weighted against the others based on perceived importance by assigning a score (1-5, with higher scores indicating greater importance). Then each concept is scored on how well it fulfils each criterion (1-5). The concept's weighted score for a criterion is then the fulfilment score times the criterion weight (1-25). These weighted scores are summed for each concept to give it its final technical value. (Pahl Gerhard & Beitz Wolfgang, 2007)

Table 7.2: Kesselring matrix with test values to demonstrate the method. Concept 1 scoring 25 points and Concept 2 scoring 28 points

		Concept 1		**Concept 2**	
	Weight (1-5)	fulfilment (1-5)	weighted score (1-25)	fulfilment (1-5)	weighted score (1-25)
Criterion 1	1	3	1*3=3	2	1*2=2
Criterion 2	5	2	5*2=10	4	5*4=20
Criterion 3	3	4	3*4=12	2	3*2=6
Sum			**3+10+12=25**		**2+20+6=28**

The Kesselring matrix offers a nuanced, quantifiable ranking of viable concepts and helps identify their weak points, guiding concept development and selection.

7.1.6 Refinement of concepts

To refine the final concepts, their use processes were mapped and analysed. The process was split into discrete steps, such as ”Dose water in vessel” and ”Heat water in vessel”, as is shown in the example Fig. 7.2. Then each step was analysed to identify potential problems. This method of analysis was largely based on the Hierarchical Task Analysis proposed in (Bligård, 2015). For the complete set of flowcharts, see Section A.5.

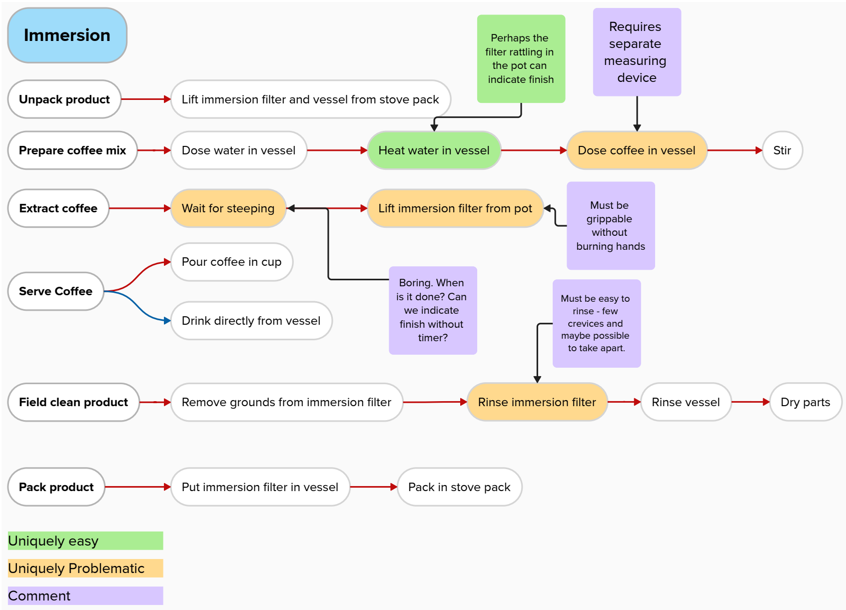


Figure 7.2: Flowchart demonstrating how the Immersion concept main process is split down into smaller parts and then analysed.

The comments were then reformulated into problem statements for which multiple solutions were ideated. The solutions to each problem statement were evaluated, and a sequence of solutions with good synergy was selected to create a new, refined version of the concept (see example Fig. 7.3). This method of exploring possibilities was based on the morphological matrices as described in (Bligård, 2015). For the complete set of matrices, see Section A.6.

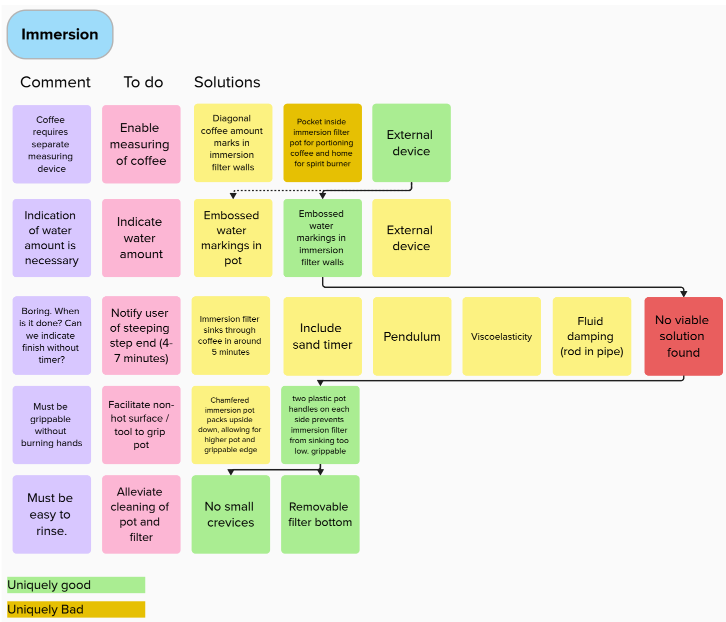


Figure 7.3: The Immersion concept comments are used as the base for a morphological matrix by converting the comments to concrete problems with solutions.

7.2 Results

The outcomes of the concept generation phase are presented here, starting with eight initial concepts and detailing the iterative processes used to filter them down.

7.2.1 8 Generated Concepts

At this stage in the development process, the concepts generated had varying levels of resolution. Some of the concepts utilised existing brewing methods deemed feasible, while others were more experimental and required earlier exploration to evaluate feasibility. Most concepts also had several different variants, each with different properties. Therefore, the concepts presented below should be understood as categories of coffee-brewing methods rather than complete concepts.

Filter Holder

A common method of brewing coffee is ”Pour-over”. The method utilises a filter holder, which is a structure that holds a thin, roughly conical filter - usually a paper filter. By portioning coffee grounds into the paper filter and incrementally pouring hot water through it, coffee is extracted, and the filter holder walls funnel the brewed coffee into a receiving vessel.

The concept of Pour-over coffee was uncovered early in the process of researching coffee brewing methods. Hence, no process was necessary to ideate the underlying principles for this product. As similar products had been identified during benchmarking (for example, the GSI Ultralight Java Drip tested in Section 4.2.2), the product’s feasibility was not in question either. Rather, the focus was on adapting it to the needs of users, the use context, and Trangia as a brand. To facilitate this, brain-drawing and sketch-based discussion were used. Inspiration was also taken from existing Trangia products, specifically the ”Trangia Triangle” - a flat-pack burner support constructed from interlocking thin sheets of stainless steel.

To evaluate concept assembly and scale, and to familiarise the project team with the product architecture, one of the filter holder concepts was selected for simple prototyping using paper, cardboard, and laser-cut vinyl, with a stiffness similar to that of the stainless steel sheet used in the Trangia Triangle. Later, during a visit to the Trangia factory in Trångsviken, a crude steel prototype was also created by cutting into a Trangia Triangle, which served as the basis for this filter holder concept. The above-mentioned prototypes are shown in Fig. 7.4.

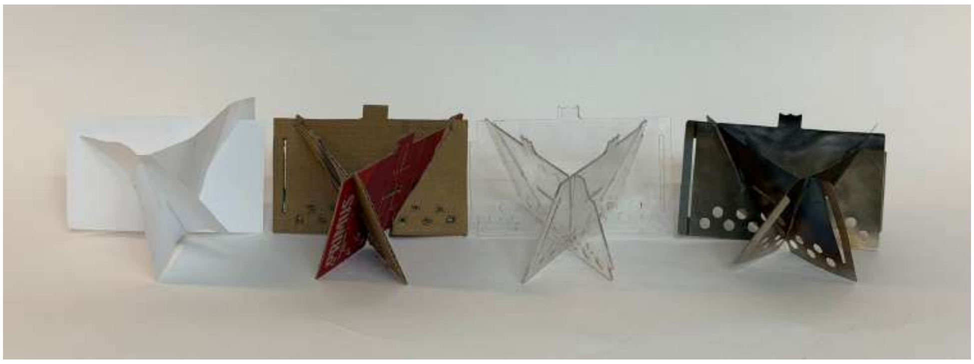


Figure 7.4: Four prototypes of increasing fidelity for a filter holder adaptation of the Trangia Triangle.

Pros

- Low complexity
- Clear cup
- Low weight/volume
- Stimulating brewing process
- Tight link between process and result
- Easy to clean
- High coffee connoisseur appeal

Cons

- Produces waste unless an infinity filter is used
- Attention-demanding, sensitive process
- Risk for cold coffee
- Requires two vessels
- Crowded market; small space for innovation
- Sensitive to pot diameter

Conclusively, the filter holder provides a well-known, straightforward, minimalist solution for brewing coffee outdoors, with promising flat-packing opportunities and an attractive flavour profile. The process is, however, quite sensitive and attention-demanding, which might not suit the intended target user group.

Auto Drip

During user observations, it was found that the pour-over method was not ideal for brewing multiple cups of coffee at once. The time and attention required for the pouring step (5-8 minutes) felt tiring for participants. The Auto Drip concept automates this pouring step by using the principles of a percolator. The water is boiled in a Trangia pot with a pump base at the bottom that catches steam bubbles. This pumps water through a pipe to a filter holder, where the hot water passes, extracting the coffee.

The idea of the Auto Drip was developed through brain-drawing on the topic of ”set it and forget it” solutions. It was later refined in a more focused brain-drawing session, with the rough concept as a base. Examples of early resulting sketches are shown in Fig. 7.5.

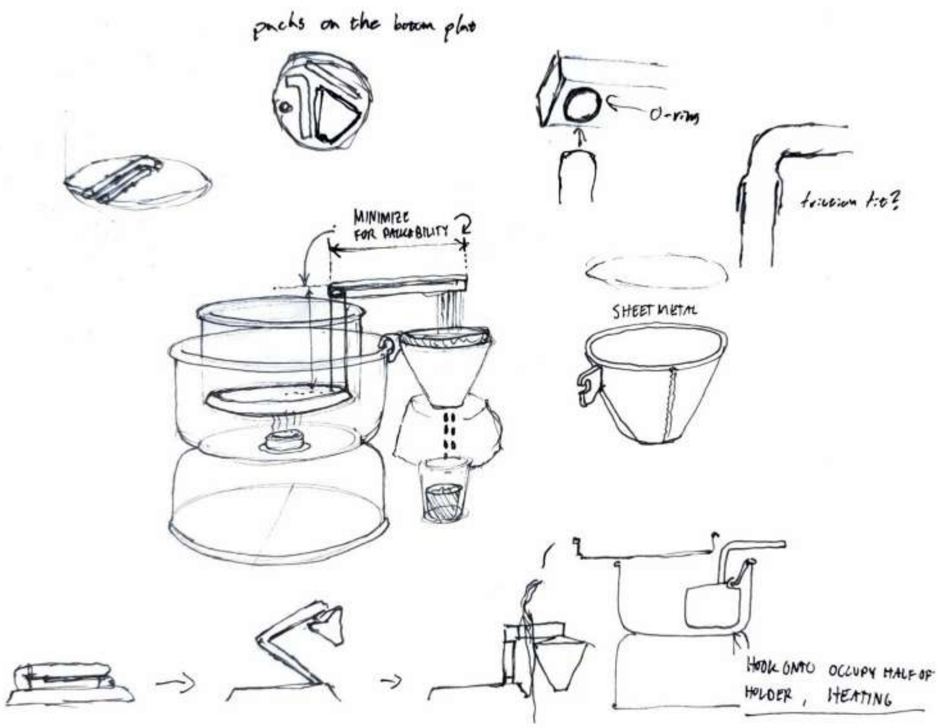


Figure 7.5: Early sketches of the Auto Drip concept.

A prototype was constructed to validate concept feasibility. An aluminium pump base was constructed and mounted on a pipe to evaluate the principle of moving water. The filter holder was prototyped from paper to simulate how a metal sheet could be formed. The conclusion was that the concept was feasible. Prototypes are shown in Fig. 7.6.

Figure 7.6: Left: First Auto Drip prototype tested with the GSI Pour Over as filter holder. Right: Early Auto Drip filter-holder prototypes made out of paper.

The Auto Drip concept provides a "set it and forget it" solution, which many users described as desirable. The process of use requires more assembly steps than some other solutions, but the automated dripping part is satisfying to watch.

Pros

- ”Set it and forget it” convenience
- Very close to a drip coffee experience
- Clear cup with even extraction
- New and exciting for outdoor use

Cons

- Bulky form factor
- Two pots required
- Long setup time
- Low coffee connoisseur appeal

French Press

French press coffee is brewed by steeping coffee grounds in hot water, then pressing a filter through the mixture to separate the grounds from the extracted coffee.

French press coffee is a simple and to many familiar way to brew coffee. User interviews also revealed that it is the preferred outdoor brewing method for many. Since the product concept already existed, brainstorming efforts focused on adapting it for outdoor use and aligning it with Trangia’s brand values. For the same reason, prototyping was deemed unnecessary for evaluation. Instead, basic testing was conducted with existing French presses. Early sketches for this concept are shown in Fig. 7.7.

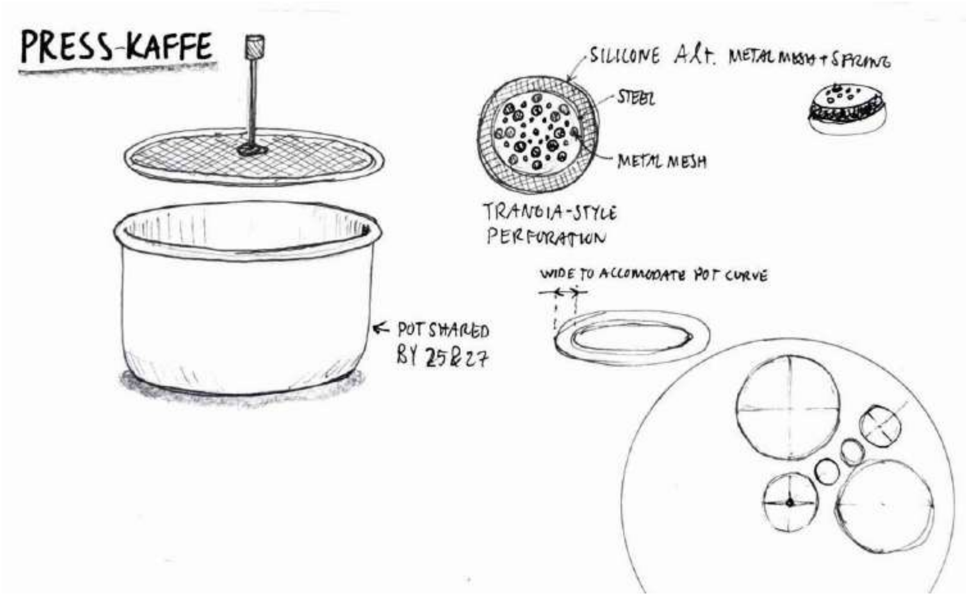


Figure 7.7: Early sketches of the french press concept.

Because the French press product architecture only requires one vessel that can both heat water and extract coffee, it naturally occupies little space. The process is intuitive and familiar to many, but the steeping phase is unengaging and may feel boring to some. The resulting cup of coffee is not the clearest, but since the product concept is widely used among Swedes, it is likely to be to many people’s liking. A common critique of the French press that was raised by several participants in the user study is its' lack of cleanability.

Pros

- Easy to use and understand
- One-pot solution
- Stays warm
- Accepted flavour
- Familiar

Cons

- Large filter (cleaning can be hard)
- Can produce muddy cup
- Relatively low coffee connoisseur appeal
- Low stimulation due to passive wait times
- Risk of overextraction

Vacuum Top

When researching coffee brewing methods, the coffee syphon, also called the vacuum pot, stood out as especially intriguing. Looking more closely at various brands of vacuum pots, it was found that the Bodum Pebo does not use a conventional paper or cloth filter but instead uses a ribbed plastic cone held against a glass vessel ("BODUM® Pebo filter product page", n.d.). The coffee filtration concept dates back to a 1960s patent (Bodum, 1962) and works by trapping coffee grounds between the ribbed plastic walls and the smooth glass surface, allowing only the extracted coffee to pass through. To facilitate further mention of this technique, it will be referred to as the "vacuum filter" throughout the report. Although creating a vacuum would elevate product complexity, if the vacuum filter could be used without a vacuum, it could provide substantial advantages for outdoor use - including high cleanability, durability and simplicity.

Brain-drawing and sketch-based discussions were used to develop concepts that utilised this filtration method. The "Vacuum Top" concept resembles the top of a standard coffee syphon architecturally, but it more closely mirrors a filter holder in its function. The product is first placed on top of a receiving vessel. Coffee and hot water are then poured into the container, after which the extracted coffee flows through the ribs of the plastic filter in the bottom of the container. An early prototype/test rig is shown in Fig. 7.8.

Figure 7.8: Vacuum Top test rig assembled (left) and disassembled (right).

To investigate the feasibility of this method, further research was conducted. Over 40 test brews were performed using 3D-printed test rigs with varying design parameters. The test rig architecture is shown in Fig. 7.8, and examples of different variations are presented in Fig. 7.9. It was ultimately concluded that certain configurations enable vacuum-free coffee brewing using the filtration method. However, as shown in Fig. 7.10, coffee clarity varied greatly between tests. To brew a clear cup of coffee, the plastic cone's texture must be very fine, which substantially restricts flow, making the process impractical and time-consuming.

Figure 7.9: Different variations of Vacuum Top test rigs.

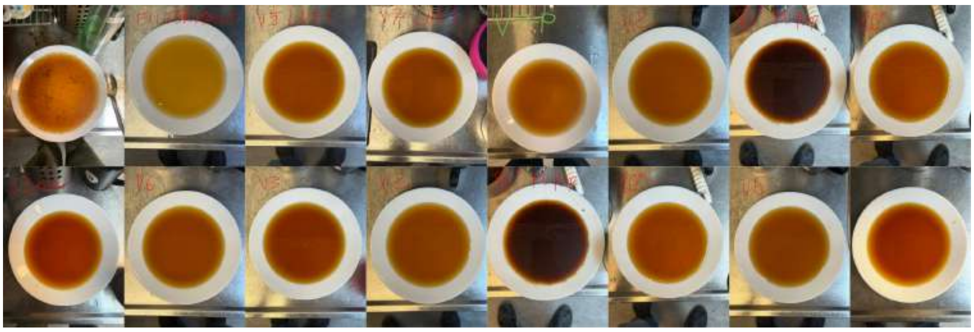


Figure 7.10: A collage of some of the plates of coffee which were photographed during the vacuum filter evaluation.

Pros

- Very easy cleaning
- (New) and exciting filter method
- Relatively clear cup result
- Semi ”set it and forget it” convenience
- Tight link between process and result
- Potential coffee connoisseur appeal

Cons

- Sensitive to deformation
- Bulky form factor; two pots needed
- Unfamiliar to most users
- Risk of cold coffee
- Sensitive to pot diameter

Vacuum Press

To address the low flow rate issue with the vacuum filter, as described in Section 7.2.1, means of applying external pressure were explored. One of the more promising approaches was to apply the French press principle. The vast majority of French presses use a metal mesh to filter the coffee. Our user studies revealed that this mesh was particularly hard to clean. The vacuum filter is theoretically much easier to clean, thereby addressing one of the biggest weaknesses of the standard French press.

As the validity of the Vacuum Press solution was uncertain, prototyping was used extensively to evaluate the concept early on. The prototypes were used to test whether the flow rate could be increased sufficiently for fine-textured vacuum filters and how much pressure was required to depress the plunger. Three iterations of prototyping, shown in Fig. 7.11 and Fig. 7.12, and testing with water and coffee confirmed that the coffee can be filtered similarly to a regular French press, using a reasonable amount of force.

Figure 7.11: The two first prototypes for the Vacuum Press concept.


Figure 7.12: The final prototype of the Vacuum Press concept assembled (left) and disassembled (right).

The Vacuum Press concept fuses the cleanability and robustness of the Vacuum filter with the familiarity and simplicity of the traditional French press process. In addition to improving cleanability, the vacuum filter implementation also hinders overextraction by reducing the contact area between spent coffee grounds and the extracted coffee.

Pros

- Easy to use and understand
- One-pot solution
- Stays warm
- Accepted flavour profile
- (New) and exciting
- Easier to clean
- Robust
- Potential coffee connoisseur appeal

Cons

- Filter style needs further research
- Low stimulation due to passive wait times
- Risk of overextraction, but lower than traditional French press

Centrifugal

Similar to the Vacuum Press, the "Centrifugal" coffee-brewing concept was born from the need to increase the flow rate of coffee through the vacuum filter. The FMT identified several ways to apply pressure to the coffee, among them centrifugal force, which stood out as an exciting and playful alternative, though its feasibility was questionable. Exploration through sketching and discussions led to a concept, which was then prototyped and tested to determine whether the centrifugal force was sufficient to increase the vacuum filter's flow rate. The prototype is shown in Fig. 7.13 and Fig. 7.14.

Figure 7.13: Centrifugal concept 3D-printed prototype disassembled.

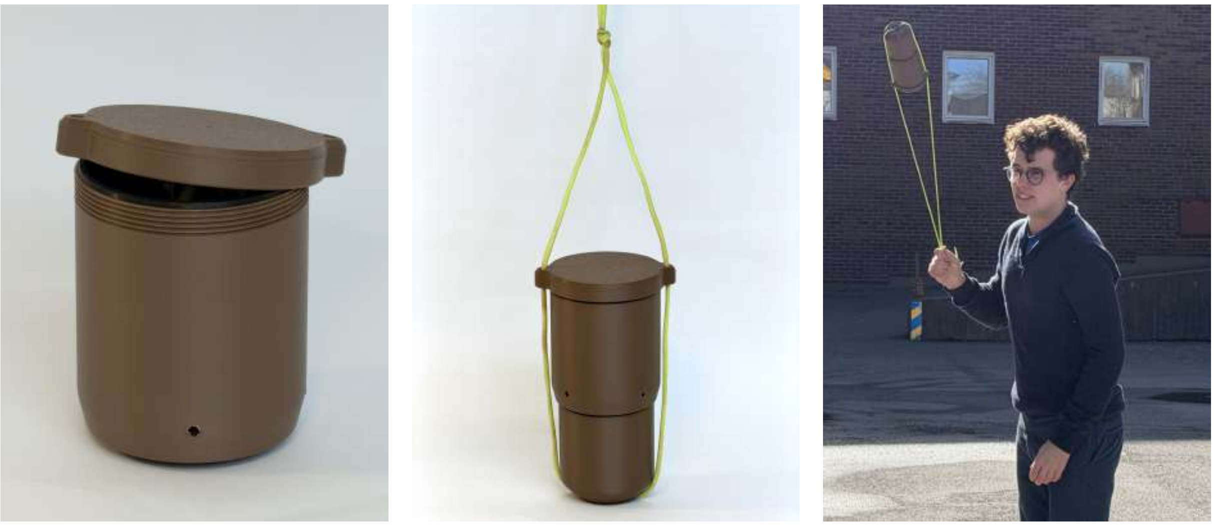


Figure 7.14: Centrifugal concept 3D-printed prototype in packed mode (left), expanded mode (middle), and in use (right)

Testing the 3D-printed prototype showed that the centrifugal force did not substantially improve the flow rate. Although entertaining, swinging a heavy coffee-filled object at high speed was uncomfortable, both mentally and physically, for the primary user and those in the surrounding area.

Pros

- Fun and engaging process
- Tight link between process and result
- Should produce a solid grounds puck — easy to clean

Cons

- Dangerous to use in practice
- Heavy, strenuous, and stressful
- Does not produce sufficient pressure
- Uncertain when extraction is complete

Pressure

One of the most active segments in the outdoor coffee brewer market is espresso brewers. To make espresso or espresso-like coffee, high pressure is needed. Traditionally, this is achieved through mechanical pumps or steam pressure.

As the product should be a relatively low-complexity solution and manufacturable using existing methods, alternative methods for creating high pressure were ideated through brain-drawing and discussions assisted by sketching. The most promising method developed was to press the water through the coffee and filter using the user's own body weight, which has inherent problems. Other concepts were either too complex or unfeasible. Along with other cons, this rendered high-pressure methods unsuitable. No prototypes were built, and this coffee-brewing method was eliminated early on.

Pros

- Hot coffee, fast brewing time
- Luxurious, high-quality result
- High coffee connoisseur appeal — trendy method

Cons

- Adds significant mechanical complexity
- Strong competing products already exist
- Does not align with Trangia's brand values
- Produces small cup volumes only

Immersion

One of the easiest ways to brew coffee is by steeping, in which the coffee grounds sit in hot water for a period of time and are later separated from the brewed coffee. The simplest identified way to achieve this is by using a sieve-like structure. The coffee grounds are placed in the sieve, which is then placed in the water, and later removed to serve the coffee.

The immersion concept is already a well-established brewing method, and the idea came from market research. Various types of immersion brewers were explored through sketches and discussions, shown in Fig. 7.15, with sieve styles ranging from traditional tea sieves to basket-like solutions. No prototype was constructed because the underlying principle was deemed feasible.

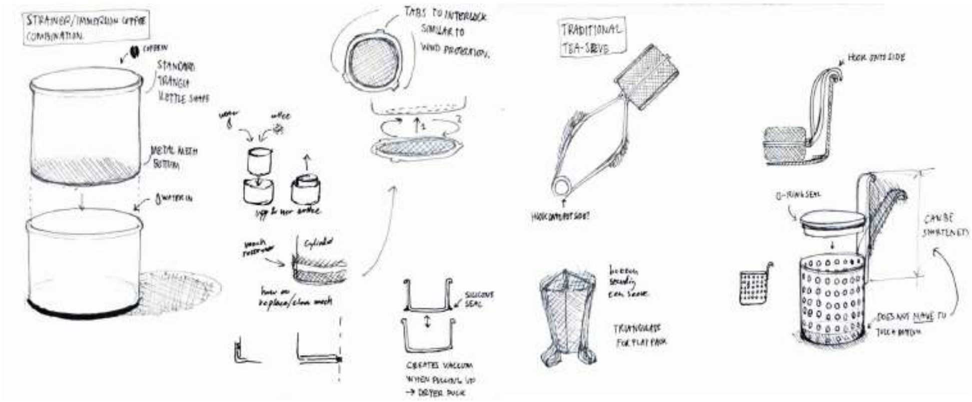


Figure 7.15: Early sketches of immersion concept variants.

Early on, this concept was regarded as unexciting but efficient. The process of brewing is very uninvolved and simple. It also allows for brewing tea and could serve a second purpose as a strainer for cooking. However, the large required filter area results in poor cleanability and increases the risk of overextraction.

Pros

- Very easy to use
- Very low complexity
- One-pot solution — stays warm

Cons

- Risk of overextraction
- Very low stimulation — passive process
- Low coffee connoisseur appeal
- Large filter area to clean

7.2.2 Eliminations

The elimination matrix was used to exclude concepts that did not meet the criteria interpreted from the user studies. The result was that Centrifugal, Pressure and Vacuum Top were eliminated, as shown in Table 7.3.
The Pressure and the Vacuum Top were both eliminated because they were not feasible. For the Pressure concept, designs that were in line with Trangia's capabilities and brand would not conveniently produce coffee. The Vacuum Top did not brew coffee fast enough after extensive prototype testing. The Centrifugal brewer was eliminated due to safety concerns about swinging a heavy container containing hot liquid.

After excluding these three concept categories, five feasible concepts remained.

Table 7.3: Result from the elimination matrix

Concept	Feasibility	Aesthetics	Brewing	Cleaning	Compatibility	Environment	Lifespan	Packability	Results	Safety	Size	Usability	Waste	Decision
French Press	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Vacuum Press	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Filter holder	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Immersion	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Pressure	-													-
Vacuum Top	-													-
Centrifugal	+	+	+	+	+	+	+	+	+	-				-
Auto Drip	+	+	+	+	+	+	+	+	+	+	+	+	+	+

7.2.3 Kesselring

The criterion's weighting was based on the Likert scale results from the user studies (Fig. 5.6). The criteria that were not in the original Likert scale (for example, manufacturability) were weighted based on their perceived importance compared to the other criteria.

The Kesselring matrix guided the elimination of the French press because it scored significantly lower than the other three concepts, as shown in Table 7.4.

Table 7.4: Result of the Kesselring matrix

Criteria		Solutions									
		French Press		Vacuum Press		Filter holder		Immersion		Auto Drip	
Name	Weight	v	t	v	t	v	t	v	t	v	t
Cost	4	3	12	3	12	5	20	4	16	3	12
Manufacturability	4	4	16	3	12	5	20	4	16	3	12
Aesthetics	2	5	10	5	10	5	10	5	10	4	8
Brewing	4	3	12	3	12	2	8	3	12	4	16
Cleaning	4,5	2	9	4	18	5	22,5	2	9	4	18
Compatibility	2	5	10	5	10	4	8	5	10	2	4
Stability	3	4	12	4	12	3	9	4	12	5	15
Lifespan	5	2	10	4	20	4	20	3	15	4	20
Packability	4	4	16	4	16	5	20	4	16	3	12
Results	4	3	12	4	16	4	16	3	12	5	20
Safety	2	4	8	4	8	3	6	5	10	3	6
Multiple cups	4,5	4	18	4	18	2	9	5	22,5	5	22,5
Usability	3,75	5	18,75	4	15	3	11,25	5	18,75	4	15
Waste	3,5	5	17,5	5	17,5	4	14	5	17,5	4	14
	Result:		181,25		196,5		193,75		196,75		194,5

7.2.4 4 Remaining Concepts

Following the initial elimination phase, the four remaining concepts underwent rigorous refinement to translate the more abstract ideas into coherent, functional coffee-brewing solutions. This stage focused on optimising user interaction, material selection, and integration with the existing Trangia ecosystem. Each concept was further developed through detailed 3D modelling to evaluate mechanical feasibility and spatial constraints. The following sections detail the final designs for each concept, including their technical specifications, material choices, and storage solutions.

Vacuum Press

Large thin-walled aluminium cylinders are at high risk of denting, which could compromise the tolerance between the press and the vessel walls. Large radii at the vessel's bottom edges can prevent the press from reaching the bottom. Therefore, a press coffee solution works best with deeper vessels with relatively sharp bottom edges. Currently, Trangia does not manufacture any vessel with a depth larger than one diameter, and most pots have relatively large fillets along the bottom edges. But a concept for a deeper vessel capable of holding a 230 g gas canister is under development. This concept would work well in tandem with the Vacuum Press. Hence, the Vacuum Press concept was developed to operate with a vessel capable of carrying a 230 g gas canister.

The main focus during the refinement process was to make the concept's assembly and storage convenient and to adjust the design to suit available manufacturing techniques. The concept's function and overall appearance are illustrated in Fig. 7.16. The filtration section consists of two parts pressed together by a rod, yielding a relatively low number of parts and assembly complexity (see the left side of Fig. 7.17). The lid can be slid over the rod, making assembly easier than with a normal French press, where a knob on the top of the rod often prevents the lid from being fully removed.

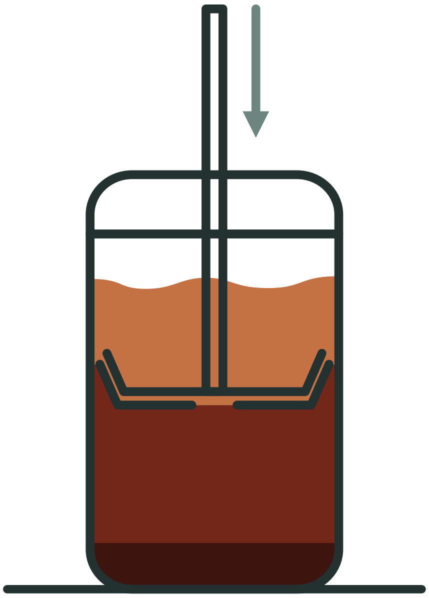


Figure 7.16: Left: Illustration of the brewing principle, showing how the coffee is separated from the coffee grounds. Right: Concept rendered in a potential use environment, created using generative AI (Google, 2026).

Figure 7.17: Left: Section view of the Vacuum Press, with the filter pressed to the bottom of the vessel. Right: The Vacuum Press in its packed position with a 230g gas canister inside.

In the packed position, as seen in the right image of Fig. 7.17, the filtration section is stored at the bottom of the container, with the gas container on top of it. Ideas for what to do with the rod during storage were explored, but no clear solution emerged that balanced part count and simplicity. The most realistic solution was to store the rod outside the vessel in a textile case that encloses the entire product.

Aligned with Trangia's material choices, the Vacuum Press is mostly made of aluminium, offering low weight and high machinability. A silicone seal is used between the filter and the container walls, leveraging its superior thermal resistance and food-grade qualities. The black interaction areas on the rod and the pot lid are made out of plastic to reduce thermal transfer and make them safe to touch.

Immersion

The earlier immersion concept was quite broad and needed to be condensed into a single, coherent solution. A short evaluation of the different configurations and sizes was conducted to understand their strengths and weaknesses. The resulting consensus was that a large pot with a replaceable metal mesh-bottom, nested into the Trangia stove 25 or 27, was the superior option (see Fig. 7.18).

Figure 7.18: Left: Illustration of the brewing principle, showing how the coffee is separated from the coffee grounds. Right: Concept rendered in a potential use environment, created using generative AI (Google, 2026).

This concept provides high packability and can easily produce multiple cups of coffee. The removable and replaceable mesh helps with cleaning and longevity.

During the concept refinement process, the main problems identified and solved were related to cleaning and measuring. Attempts were made to indicate the steeping time, but no viable solution was found. See Fig. A.12 for complete refinement process results.

The body is made of aluminium with a stainless steel mesh attached to the bottom. The mesh is moulded into a plastic frame that threads onto the main body, as shown in the left image of Fig. 7.19. Two small plastic handles on the top alleviate the removal of the solution when it is pressed down into the pot, as seen in the right image of Fig. 7.19.

Figure 7.19: Left: Immersion concept shown in exploded view with the removable metal mesh filter unscrewed from the main body. Right: Immersion concept shown nested in the pot.

Filter holder

As with the immersion concept, the filter holder needed to be condensed into a single, coherent concept. Different solutions were explored and evaluated, as shown in Fig. A.11. The chosen concept was a filter holder made out of a single piece of sheet metal that folds in on itself to form a cone. The cone rests on a disc with grooves for different pot sizes, as shown in Fig. 7.20. It delivers on packability, cost (manufacturability), durability, and a low part count.

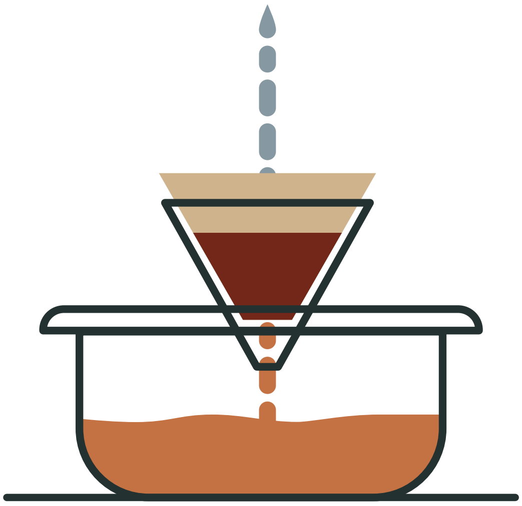



Figure 7.20: Left: Illustration of the principle, showing how the coffee is separated from the coffee grounds. Right: Concept rendered in a potential use environment, created using generative AI (Google, 2026).

To maintain the filter holder's conical shape, the ends of the filter holder latch together to form a secure connection (see the left side of Fig. 7.21). The ridges in the filter help minimise contact between the filter holder and the filter, reducing thermal losses during brewing. The filter holder is designed for standard (1×4) paper coffee filters, but it can also be used with similarly sized infinity filters. A disc was selected for the filter holder to rest on because of its superior rigidity, simplicity, and thermal insulation of the brewed coffee.


Figure 7.21: Left: Close-up of the latching mechanism on the filter holder, which keeps the cone together. Right: The filter holder in its pack position.

The refinement of the concept was focused on improving stability during brewing and packability when not in use. Stability was achieved by implementing grooves in the filter holder and the disc, which align and stabilise the parts. As shown in the right image of Fig. 7.21, the flat-packing filter holder and the relatively flat disc both fit conveniently in the stove's frying pan, occupying very little space.

The filter holder material is stainless steel, which is food-safe and has excellent elasticity, allowing it to flex into and out of a conical shape without permanent deformation. The support disc that holds the filter holder is made of aluminium, chosen for its manufacturability, low weight, and alignment with Trangia's current production.

Auto Drip

The overall architecture of the Autodrip concept was largely unchanged during its refinement. The principle for filtering and pumping water remained the same, as illustrated in Fig. 7.22.

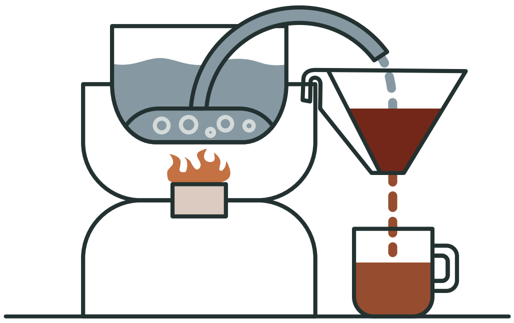


Figure 7.22: Left: Illustration of the principle, showing how the coffee is separated from the coffee grounds. Right: Concept rendered in a potential use environment, created using generative AI (Google, 2026).

The main focus of refining the Auto Drip concept was to ensure that the connections between parts were rigid yet easy to assemble. To achieve this, the arched pipe is clipped onto the edge of the pot, as shown in the left image of Fig. 7.23, and slid onto a protrusion on the pump base. To ensure high packability and easy mounting of the filter holder, a solution similar to the Filter Holder concept was selected (a sheet metal profile folded into a cone). The sheet metal profile has hooks that latch onto the edge of the Trangia stove's wind protector for easy mounting and dismounting. The pipe and pump base can be stored in the small pot of the 25, while the filter holder can be stored in the frying pan above, as shown in the right image of Fig. 7.23.

Figure 7.23: Left: Close-up on how the metal clip on the pipe sits on the pot. Right: The Auto Drip in its pack position.

The pipe and pump base is made out of aluminium for its light weight and machinability. The clip and the filter holder are made of stainless steel, which has the elasticity needed to ensure a sturdy clip grip and to enable the conical filter holder design.

8

Selection and Refinement

With four viable concepts remaining, this chapter focuses on the final selection process and the subsequent detailed refinement. It outlines the methodologies for choosing the winning concept and the rigorous testing required to optimise its design.

8.1 Methods

This section explains the strategies used to evaluate and refine the remaining concepts. It covers comparative analyses, stakeholder consultations, iterative prototyping, and the framework for estimating production costs.

8.1.1 Pros, Cons and User Group

To evaluate each concept further, they were analysed for their pros and cons in relation to user needs and to one another. Then, the most prominent pros and cons were stated, serving as a basis for a qualitative decision on which concept to continue developing. The pros and cons, along with pictures of the concepts, help communicate their unique aspects efficiently to external parties. To convey their expected appeal to different user groups, the concepts were also mapped onto the persona map displayed in Fig. 5.4, aiding the evaluation process.

8.1.2 Concept Selection and New Demands

While all four remaining concepts were viable and capable of fulfilling the product's core requirements, they catered to different target users and satisfied varying design requirements. To determine which concept to progress into detailed design, Trangia's team of product developers and management were consulted. All four remaining concepts were presented using rendered images, such as the ones presented in Section 7.2.4, along with their most prominent pros and cons. A moderated discussion was held in which the potential of each concept was evaluated based on its strengths, weaknesses, and how well it suited the company, its product portfolio, and current strategy.

After selecting one concept to be developed further, discussions were held about which problems needed to be solved and what additional demands should be placed on the specific concept. This helped guide the later development.

8.1.3 Refinement of Individual Parts

After the final concept was selected and the new demands were identified, the concept needed further refinement and modifications. This was done by reformulating the new demands into more specific terms related to each part of the concept. Idea generation for the specific parts could then be performed. The refined concept results from updating each part separately and ensuring compatibility among them.

This refinement methodology was selected because Trangia's new demands primarily concerned packability and compatibility. Therefore, the underlying function and architecture did not need to be altered. This made it possible to separate the parts and modify them individually to meet the new demands.

8.1.4 Prototyping and Testing

At this stage, rapid prototyping and semi-rapid prototyping were used intensively for several purposes related to developing the final concept design. In the early stages, quick prototypes in cheap and time-efficient materials were constructed and evaluated to iteratively optimise designs that met the initial requirements along with the new demands placed on the product from the consultation with Trangia. Later on, prototypes in their intended metallic materials were fabricated - partly to enable evaluation of the concept with hot water, but also to assess the manufacturability of the design.

Unstructured test-fitting and experimentation with final concept prototypes were conducted throughout the process to guide development. In addition, two rounds of more structured testing were performed. Firstly, different variations of the two components of the final concept were evaluated in use. The evaluation was carried out by measuring the water flow rate over a set period for different setups with these components, which helped guide design decisions for the final prototype. The testing setup is shown in Fig. 8.1

Figure 8.1: Picture of the setup for early prototype testing.

Secondly, the final prototype was analysed by measuring time, temperature, and the weight of water and coffee across multiple brewing cycles with varying amounts of coffee, using both the 25 and 27 stoves. The testing environment was outdoors with a temperature of around 17°C, low wind speeds and sunny weather. In other words, a very forgiving environment for brewing hot coffee. Other statistics, such as assembly and cleaning times, were also evaluated through testing within the project group. The setup for the testing is shown in Fig. 8.2.

Figure 8.2: Picture of the setup for testing the final Auto Drip prototype.

8.1.5 Aesthetic evaluation

To evaluate the aesthetics of the final concept in relation to the guidelines set in Chapter 3, renders and pictures of the final prototype were analysed using the mood board and Design Format Analysis.

8.1.6 User evaluation

The final prototype of the final concept was evaluated with three different users through observations and interviews. These were conducted in a manner similar to that described in Section 5.1.4 and Section 5.1.5 in that the observations were direct, obtrusive and conducted in near-natural environments. However, the interviews were less structured and more free-flowing, and the data were analysed solely using Likert scales and interview notes. For the observation part, participants were informed of the concept and shown how to assemble it. Afterwards, they were asked to assemble and brew coffee using the prototype on their own, with the option to seek guidance if needed. Any interesting behaviours were noted, and the experience was then discussed.
As shown in Table 8.1, three users of different interpreted persona groupings participated in the user evaluation, two of whom also partook in the earlier user needs elicitation detailed in Chapter 5. These participants were selected through convenience sampling, with practicality and expressed desire from participants to test the prototype having a large impact on selection.

Table 8.1: Summary of participants in interviews and observations for the user evaluation of the final concept prototype.

ID	Residence	Gender	Experience	Time (min)	Age	Persona grouping
5	Sweden	F	Casual outdoors	45	40	The Providers
6	Sweden	M	Outdoors content creator	45	50	The Ritualists
12	Sweden	M	Scout leader	45	50	The Ritualists

The user evaluation helped reconnect the development process with the user, uncovering unanticipated user behaviours and identifying flaws in the concept. Getting a preliminary indication of the user's perspective on the product as a whole was crucial for establishing recommendations for future work. Further user evaluations are needed to get a more realistic and nuanced picture of the product performance.

8.1.7 Product price estimate

To estimate the economic feasibility of the concept, a rough price estimate was conducted. The price estimate is primarily based on manufacturing and tooling costs. Smaller costs, such as packaging, logistics, and overhead, were also factored in. A pay-off time and production volume were determined, allowing the large investment to be split over the pay-off period. The investments were split into two categories: tooling and design work.

To estimate the costs of tooling and time, rough estimates were based on quick searches and consultations with Trangia. The goal was not to calculate exactly what the finished product cost ranged to manufacture, but rather to establish a preliminary cost approximation.

Different consumer prices can then be stated to evaluate profit margins, ROI, and Break-even points across different scenarios. This helps guide a final price that accounts for Trangia's profitability. The final price is guided not only by Trangia's profitability but also by qualitative judgments about what customers are willing to pay and by competitors' product prices.

8.2 Results

This section presents the final concept selection made in collaboration with Trangia, the solutions developed for identified design challenges, and the comprehensive results from both prototype testing and economic estimations

8.2.1 Pros, Cons and User Group

To support the evaluation of the generated concepts, each concept was assessed based on its key strengths, weaknesses, and suitability for different user groups. Table 8.2 summarises the main advantages and disadvantages identified for each concept, while Fig. 8.3 illustrates how the concepts relate to the previously defined persona groups.

Table 8.2: The pros and cons of the four concepts

	Pros:	**Cons:**
Immersion	Low complexity	Lower clarity
	Single vessel solution	Risk of over-extracted coffee
	Keeps coffee hot	More difficult to clean
	Tea compatible	Long waiting time
	Potential for multiple uses	Poorer durability
Filter Holder	Low complexity	Laborious pouring (approx. 7 min for 4 cups)
	Similar to drip coffee	Requires attention during the process
	Compatible with paper filters	
	The coffee enthusiast's choice of process	Sensitive process
	Easy to clean	
Auto Drip	Set it and forget it	Complex
	Drip coffee quality	Time-consuming assembly
	Stimulating process	May be perceived as unnecessary
	Compatible with paper filters	Risk of cold coffee
	Repeatable results	
Vacuum Press	Guaranteed hot coffee	Lower clarity
	Single vessel solution	Long waiting time
	Easy to clean	
	Low complexity	
	Familiar process	
	High durability	

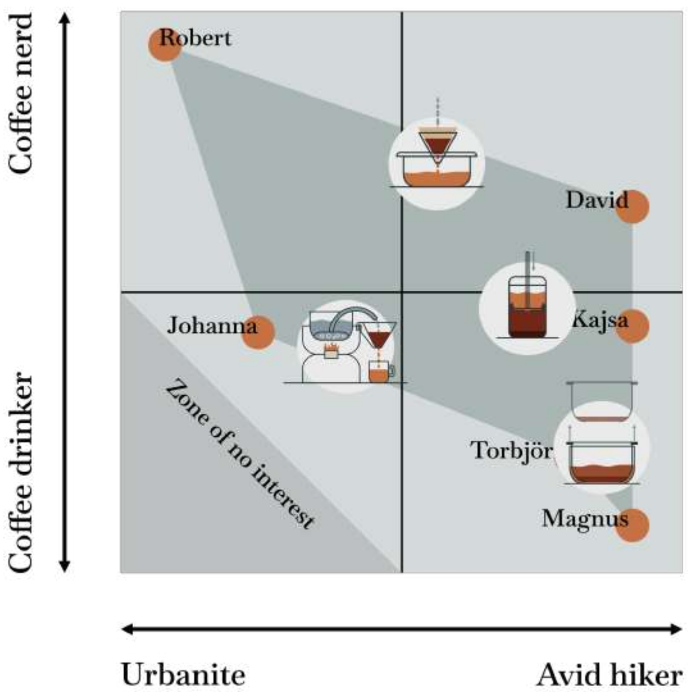


Figure 8.3: The four concepts positioned in the persona map based on expected appeal.

8.2.2 Selection of Auto Drip

Trangia was most enthusiastic about the Auto Drip concept and saw it as a better fit for their current needs. The concept's high level of innovation and unique aesthetic appeal were cited as deciding factors. Another reason was that the concept could meet the need for high manufacturability with their current capabilities. Additionally, the target user group for this concept likely represents a broad population of non-frequent users of the Trangia stove. Targeting this user group could attract new customers. This is also consistent with Trangia's objectives of enhancing accessibility and fostering more experiences in nature.

Trangia's main suggestion was to make the filter holder for the Auto Drip concept into a stand-alone product as well. This requires the filter holder to be placed on top of the pots and packed by itself. A suggestion was also made to create the filter holder from two identical pieces to reduce size and tooling costs. They also suggested using the Trangia kettle as the receiving vessel for ease of pouring and insulation, and therefore, the concept needs to be packable with the coffee kettle in the stove. Furthermore, it was suggested that the concept should fit both the 25- and 27-stove sets, thereby restricting the size of the pump base.

8.2.3 Auto Drip Problems / Solutions

To meet the new demands, the concept had to be altered in multiple ways. Solutions to the new demands were implemented into the design through extensive CAD work. The CAD models were then validated with simple prototypes, often in plastic, before a metal prototype was constructed and evaluated. Then the metal prototype often needs some more iterations to become "functional".
To establish the primary design constraints in CAD, the available design space was determined by aligning the two stoves (the 25 and 27) at the bottoms of their pots and vertically at the edge of the wind protector (see Fig. 8.4). This creates a space of minimal deviation between the two systems, making it much easier to format a single universal product for both.

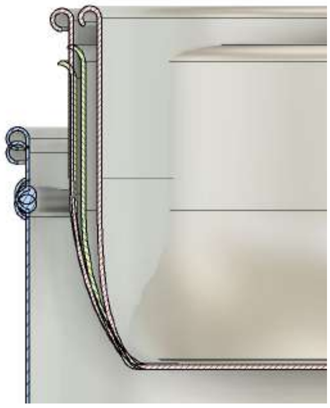


Figure 8.4: A section view showing the two stove systems aligned with each other (25 and 27).

Pump base

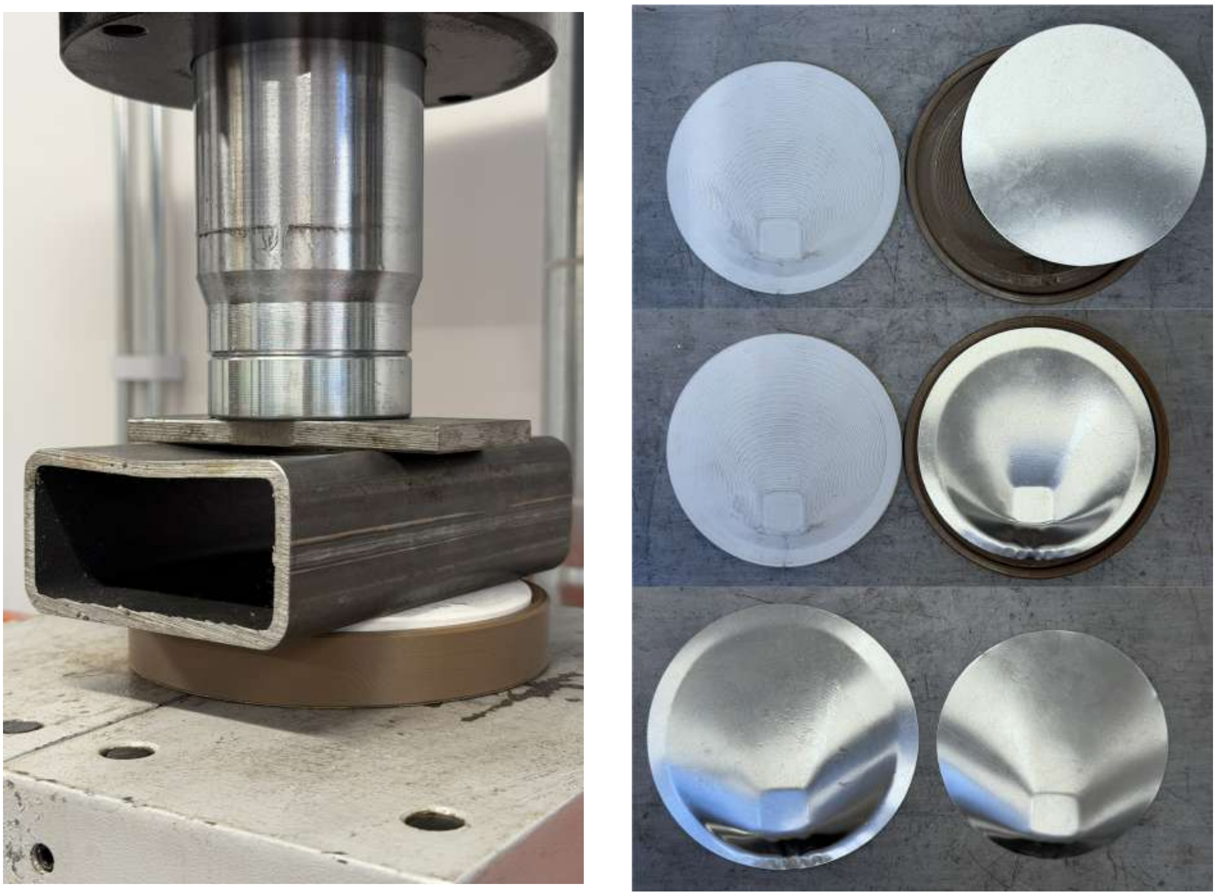


Figure 8.5: Left: Pump base is pressed into shape using a hydraulic press and 3D-printed tools. Right: Sequence of pressing and cutting for creating the pump base.

The size of the pump base was determined by the alignment of the 25 and 27 stove systems, as described earlier. The alignment yields a pump base diameter slightly smaller than the smallest pot bottom diameter in the 27 stove (see the marked area in Fig. 8.6).

Figure 8.6: Same section view as Fig. 8.4 but from a different angle with the ”shared” pot bottom area emphasised.

Different pump base shapes were evaluated (see Table 8.3); the initial prototype was essentially flat, but tests with conical pump bases showed better performance and similar packability. The connection between the pump base and the pipe is a small protrusion that slots into the pipe. It was determined that the connection was sufficient, and a prototype with an expanded end of the pipe was developed.

Pipe

The pipe's outer bend diameter was fixed by the inside diameter of the 27 stoves in its packed positions. This limited the pipe's horizontal and vertical extent, determining the position of the connection to the baseplate based on the ”end” location of the pipe, aimed at the middle of the filter holder. Different pipe shapes and diameters were tested to determine the best-performing designs (see Table 8.3).

Clip

Because of the new alignment, the clip was moved from the pot edge to the windshield. After the new alignment (see Fig. 8.4), the two windshields are slightly off in the vertical axis, so the clip has to work in two positions (see Fig. 8.4). A unified contour for the two windshields was created to maximize contact area in both situations. After prototyping (see Fig. 8.7) and testing the clip, it was deemed difficult to remove due to its lack of interaction points. A grip for the Trangia tong was developed, which flexes the clip to its open position when grabbed, making installation and removal much easier.

Figure 8.7: Bending sequence of clip prototype using 3D-printed tools.

Filter holder

The filter holder was the part requiring the most rework because it was split into two identical parts and made into a stand-alone product as well. The two parts were designed to slot together to form a cone. To help parts fit at a 90-degree corner in the joint, a louvre is placed on one side of the slot to create a wider contact point. The 90-degree corner helps maintain the filter holder's conical shape. Because 3D-printed plastic louvre tools were used when creating the prototype (see Fig. 8.8)(which cannot cut into metal), the cut was pre-machined in the part during the water-cutting stage. This results in the slot having a width equal to the kerf width (0.8 mm), which should be 0 mm if done with a real louvre tool. To compensate for this, a small piece of metal was riveted onto the sheet to make the slot thinner again.

Figure 8.8: Setup for pressing the louvre into filter holder using 3D-printed tool and laser-cut MDF.

The filter holder sits on the edge of the upper wind protector, the same position as

the clip had been moved to. This created a need for additional clearance in the filter holder, allowing the clip to be installed.
The exact shape of the hooks on the filter holder was determined over multiple prototypes in both plastic and metal to evaluate the fit and the angle at which the filter holders sit (see Fig. 8.9).
The metal filter holder was found to be too stiff; the final concept is expected to use ridges to improve both flexibility and insulation. In the prototype, holes were added to ease prototyping while keeping the part less stiff.

Figure 8.9: Three generations of laser-cut plastic filter holder prototypes. Held in tension using a metal wire.

8.2.4 Prototype Testing

To validate the refined Auto Drip design, focused testing was conducted. This section evaluates the pump and pipe mechanisms and the overall thermal and flow performance of the final prototype.

Testing Pipe and Pump Base

To test different design variations of the pipe and pump base of the Auto Drip concept, prototypes were created and tested in their ability to displace water from the pot through the pipe. The tests were performed at maximum burner output, and the water displacement was measured over 60 seconds. The test results shown in Table 8.3 indicate that an inner pipe diameter of 8 mm, with a conical pump base that directs water toward the pipe inlet, is best for quickly displacing water out of the tested setups. Meanwhile, small changes in the pipe's shape, as shown in Fig. 8.10, seem to have little effect on its performance.

Table 8.3: Table displaying performance in water displacement of different pipe and pump base setups.

ID	Pump base shape	Pipe shape	Pipe inner diameter (mm)	Water displaced in 60 s (g)
1	Bulbous cone	Smooth arch	6	35
2	Bulbous cone	Smooth arch	8	85
3	Bulbous cone	Close to pot edge	8	89
4	Flat bowl	Smooth long arch	8	75
5	Bulbous cone	Smooth long arch	8	112

Figure 8.10: Pictures of a few different setups tested. Left: ID 1. Middle: ID 3. Right: ID 5

Final Prototype Evaluation

The measurements taken from testing the final prototype using the 27 stoves are plotted in Fig. 8.11. As can be observed in the line with triangular dots on the graph, roughly 325 g of brewed coffee had landed in the receiving pot / kettle after about 400 seconds. This yields a brewing rate of 0.8125 g/s. That means a 900 g brew would take about 1100 seconds, or 18.5 minutes, which does not meet the requirement specification's limit of 15 minutes specified in criterion 1.1 of Fig. A.4.

During testing of the prototype, the filter holder was identified as the bottleneck in water flow. In some tests, the heat had to be reduced to prevent overflow. In other trials, the water level in the filter reached the pipe outlet, which pulled a portion of the water and coffee grounds into the boiling vessel. When comparing the flow rate of a standard, ridged filter holder from an electric drip coffee maker with that of the prototype filter holder, the standard filter holder flowed approximately 1.3 times faster than the prototype.
The line with square dots in the graph shows the temperature of the coffee in the receiving vessel - a Trangia kettle in this case. As can be seen, the temperature sits relatively steady around 60°C during the brewing process. As the water flow slows, the temperature starts to drop. This does not satisfy criterion 3.3 in the requirements specification, as the serving temperature will be below 60°C due to heat loss from sitting and pouring into the drinking vessel.

The line with circular dots shows the temperature in the coffee bed. As can be observed, the temperature in the coffee bed starts off at an optimal level around 95°C but steadily declines during the brewing process. This is likely due to initial insulation by the dry coffee grounds, followed by an increased heat dissipation through the metal filter holder once the entire coffee bed is saturated. As the desired coffee bed temperature for optimal extraction was set to 94-96°C in the requirement specification, the prototype nearly meets this demand.

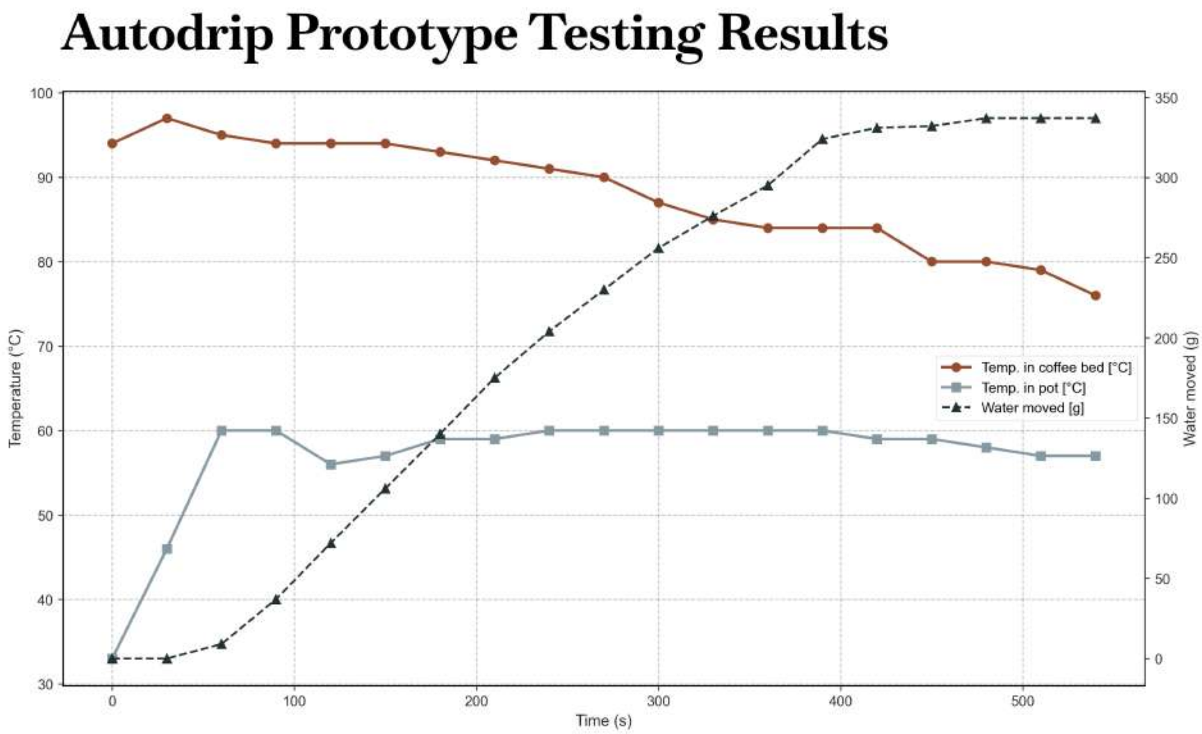


Figure 8.11: Plot of temperature measurements and water displacement results over time from testing the Auto Drip prototype with the Trangia 27 stove.

Temperatures were also measured on other points of the product around the middle of the brewing process. These results are illustrated in Fig. 8.12. As shown in the illustration, the largest temperature drops occur in the filter holder and the receiving vessel.

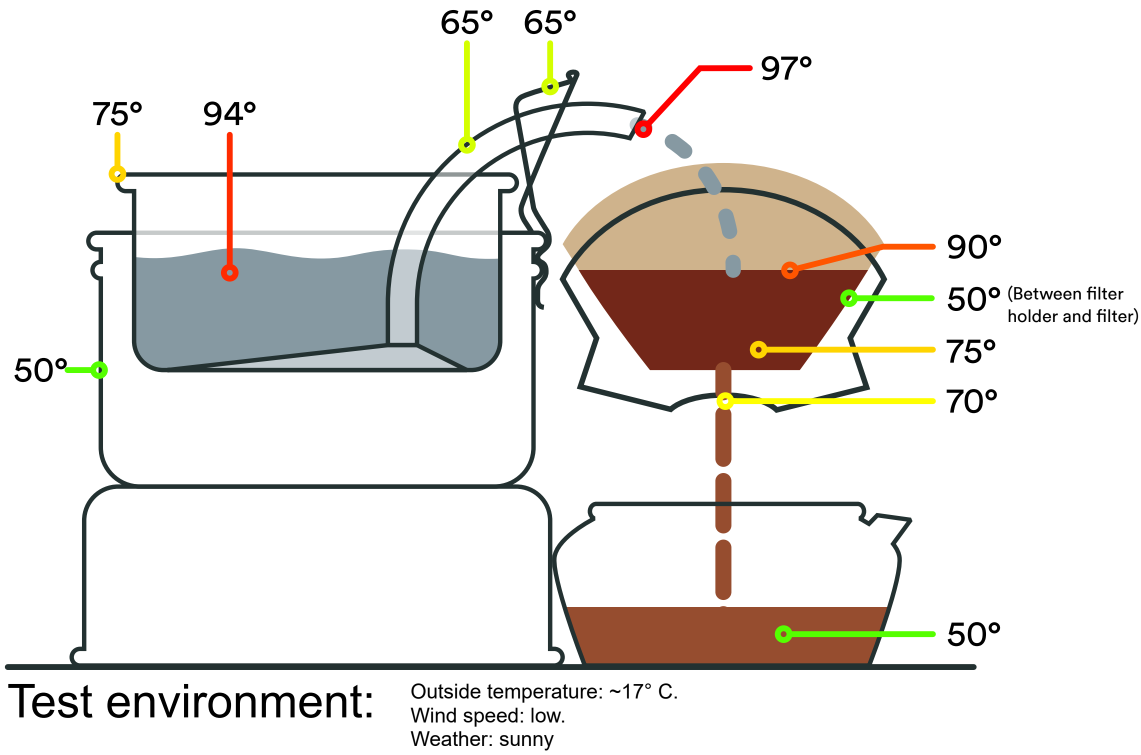


Figure 8.12: Illustration of temperature results from testing the final Auto Drip prototype.

Observing the inputs and outputs of the tests, as shown in Fig. 8.13, it is clear that a significant portion of the water was not converted to brewed coffee in the kettle. For the 27 stove test presented, about 56% of the water weight ended up in the kettle as brewed coffee. Almost 23% was lost to evaporation, and about 10% was left in the boiling pot when the water movement through the pipe had stopped. These losses must be accounted for when portioning coffee and water.

Inputs	
Water input (g)	602
Coffee input (g)	40
Starting water temp. [C	21
Flame heat	Medium

Results	
Time until boiling (s)	270
Coffee brewed (g)	337
Water left in pot (g)	61
Water in coffee filter (g)	67
Evaporation loss (g)	137
Water to coffee ratio	0,56

Figure 8.13: Inputs and results of the prototype test with the 27 stove.

In connection with the tests, the assembly and cleaning time of the product was also measured by taking the rough average of both team members' performances. The assembly time was defined as the time to install the Auto Drip components onto an already assembled Trangia 27 stove. The cleaning time was defined as the time necessary to clean the solution to satisfaction. The results, shown in Table 8.4 all fulfill their corresponding criteria in the requirement specification; see Fig. A.4

Table 8.4: Evaluation Criteria and Results

Criteria	Result
Assembly time (s)	40
Field cleaning time (s)	30
Deep cleaning time (s)	90

8.2.5 Aesthetic Evaluation

To evaluate the aesthetics of the final concept, it was applied to some of the methods described in Chapter 3.

Mood Board Compatibility

By placing the final prototype on the mood board, initially made to capture the brand's mood in Chapter 3, its aesthetic compatibility can be analysed. As shown in Fig. 8.14, the final product, although highly subjective, fits well with the brand mood.

Figure 8.14: The final Auto Drip prototype placed in the initial brand mood board.

Design Format Analysis Compatibility

Performing the same DFA method as described in Section 3.1.2, but for the final concept, its adherence to the brand design characteristics can be evaluated. The resulting score is 14, as shown in Fig. 8.15. This indicates good adherence to the design format, despite slightly missing the geometrical shapes aspect in favour of function.

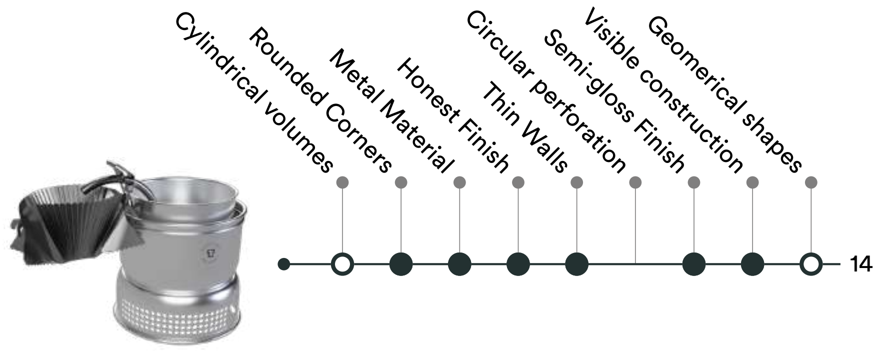


Figure 8.15: The design format analysis applied to the final Auto Drip concept.

8.2.6 User Evaluation

The user evaluation yielded a few takeaways for the concept's performance in several parts of the use process. The quantitative data were also used to evaluate the concept's overall performance in relation to user priorities.

Assembling / Disassembling the Product

All participants had difficulty assembling and disassembling the filter holder, and most expressed concern about the risk of cutting themselves during these steps. Unhooking and hooking the filter holder onto the edge of the wind protection was also something users struggled with, as the fit was very tight and the holder tended to clash with the clip. Removing some material from the hook region of the filter holder immediately alleviated this part of the assembly.
Participant 12 was only supplied with regular-sized ”1×4” paper coffee filters, for which the filter holder was designed. To fit the filter over the pipe during assembly, the user had to tear it slightly. The two participants who followed were supplied with smaller ”102” paper coffee filters and did not experience the same problem.

Tasty But Cold Coffee

Overall, the participants enjoyed the process of brewing coffee with the product, and all appreciated the taste of the finished coffee. However, the temperature of the served coffee was, as anticipated, not hot enough.

Easy Cleaning, Tricky Packing

All participants found the cleaning step highly intuitive. The filter holder parts were rinsed by two of the users, and the third simply lifted the coffee filter out of the filter holder and felt satisfied with the cleaning step.
An overarching theme in the user evaluation findings was the uniqueness of each user. Whether it is the assembly, disassembly or cleaning of the product, no two users do it the same way. In Fig. 8.16, this uniqueness is evident in the three distinct packing solutions among the participants. None of the users found packing straightforward. They had to reshuffle the components multiple times before arriving at a working configuration.

Figure 8.16: Three different methods of packing from three different user evaluations.

High Learnability

Although all first-time users struggled with assembly and packing to some extent, there was unanimous agreement that these steps would be much easier the second time. This indicates that the product has a relatively high learnability.

Overall Good Performance

The Likert scale result illustration shown in Fig. 5.6 was modified to indicate how well the final concept meets user demands. The question was changed to how well the product performs in each aspect, using the same rating scale as before. The user evaluation results were then plotted on top of the user needs analysis results, as shown in Fig. 8.17. The plot reveals that the final concept performance score for the evaluated aspects is mostly higher than the average aspect importance score, based on the findings from the three participants. Having only three participants hinders any definitive conclusion regarding the Auto Drip's commercial success, but it is indicative of a generally positive attitude towards the product.

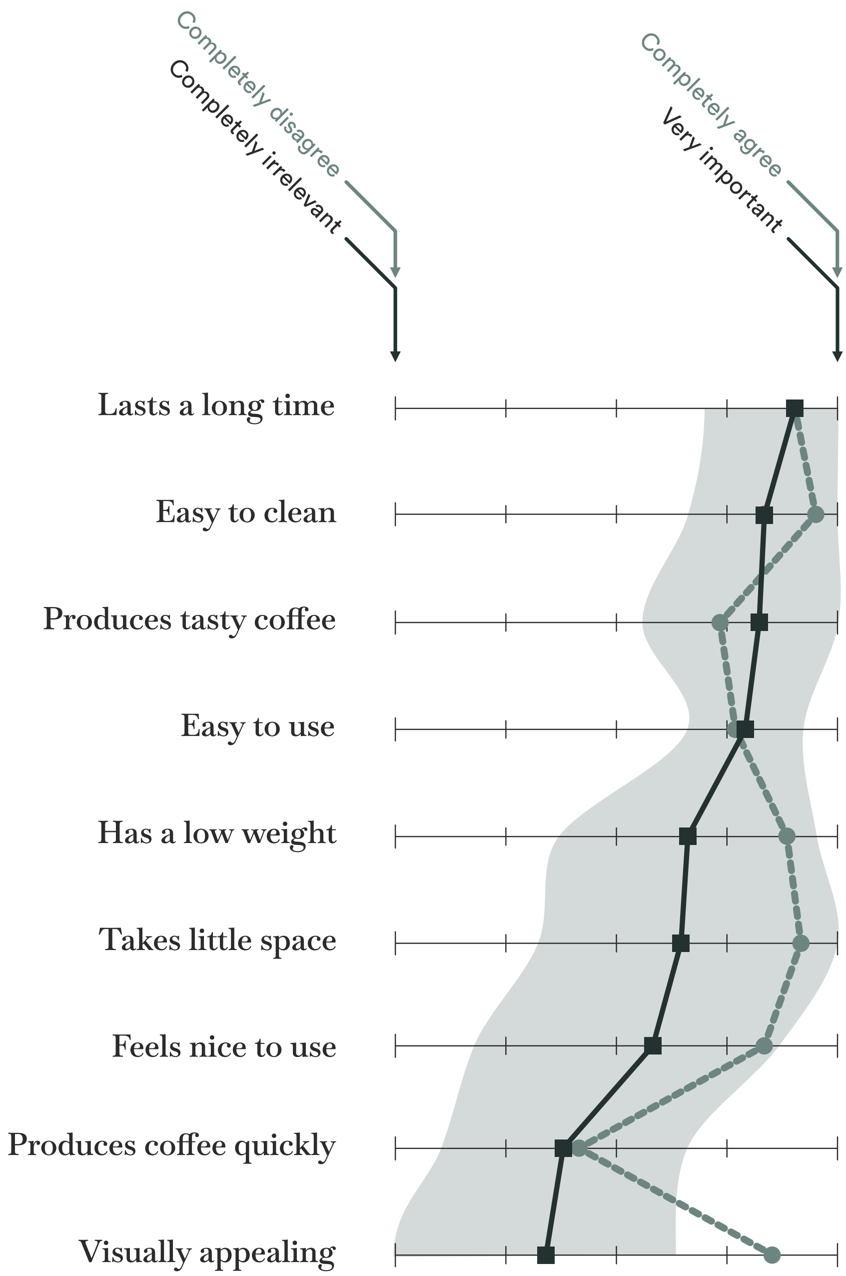


Figure 8.17: Likert scale results from user evaluation of final prototype mapped over Likert scale results from quantitative user needs analysis. The dotted line represents the average rating of the Auto Drip from the three participants.

8.2.7 Product price estimate

The price estimate yielded in-store prices of 600 SEK for the Auto Drip and 300 SEK for the Filter holder. The cost calculation was based on a 3-year pay-off period for the

investments and a total volume of 6000 Auto Drips and 3000 filter holders. Manufacturing cost per product was estimated based on the required processes and tooling. Overhead, packing and internal logistics were also taken into account.
Because the Auto Drip concept still requires further design work, the remaining effort was estimated at 12 weeks. Based on the current salary market, an investment of 192 000 SEK is needed to bring the solution to market. The tooling required was estimated to 330 000 SEK, resulting in a total investment of 522 000 SEK. This investment cost was split between the product and over the 3 years.
The final cost of the product was calculated using 20% and 40% margins for distributors and stores, respectively. The final profit over the 3 years is 356 478 SEK, resulting in a return on investment of about 68,3%. See Table 8.5 for more in-depth numbers. The resulting numbers, as described in the method Section 8.1.7, are rough estimates, and the ROI of exactly 68,3% is probably not what would happen if the project went forward. But it shows that the project is likely to be profitable; a more in-depth cost analysis is needed if more exact numbers are required.

Table 8.5: The main data regarding the costs and investments needed to produce the Auto Drip and the filter holder as two different products sharing tooling and investment costs.

	Auto Drip:	**Filter Holder:**	**Combine:**
Pay-off time [years]:			3
Volume Per Year [n/year]	2’000	1’000	
Total Volume [n]	6’000	3’000	
Total Tooling Investment [SEK]	280’000	50’000	330’000
Variable manufacturing costs per product [SEK/n]	80,64	32,20	
Manufacturing cost per product [SEK/n]	128,30	48,87	
Design Investment [SEK]	128’000	64’000	192’000
Design cost per product [SEK/n]	21,33	21,33	
Overhead, packaging & logistics [SEK/n]	34,48	18,73	
Trangia’s cost per product [SEK/n]	184,12	88,93	
Distributor and retail costs (20% and 40% margins) [SEK/n]	249,6	124,8	
Suggested Price (after taxes) [SEK/n]	600	300	
Profit margin	0,25	0,30	
Total Profit [SEK]	277’678	78’800	**356’478**
ROI	68,06%	69,12%	**68,3%**

Using the product price estimate, a break-even ”line” can be calculated based on how many units of each product sell. The break-even line is based on the investment costs and the profit of each product sold. In general, selling more Auto Drips leads to faster profitability due to higher per-product profit and a larger share of the price intended to repay its larger investment in tooling and design work (see Fig. 8.18 for the exact break-even line).

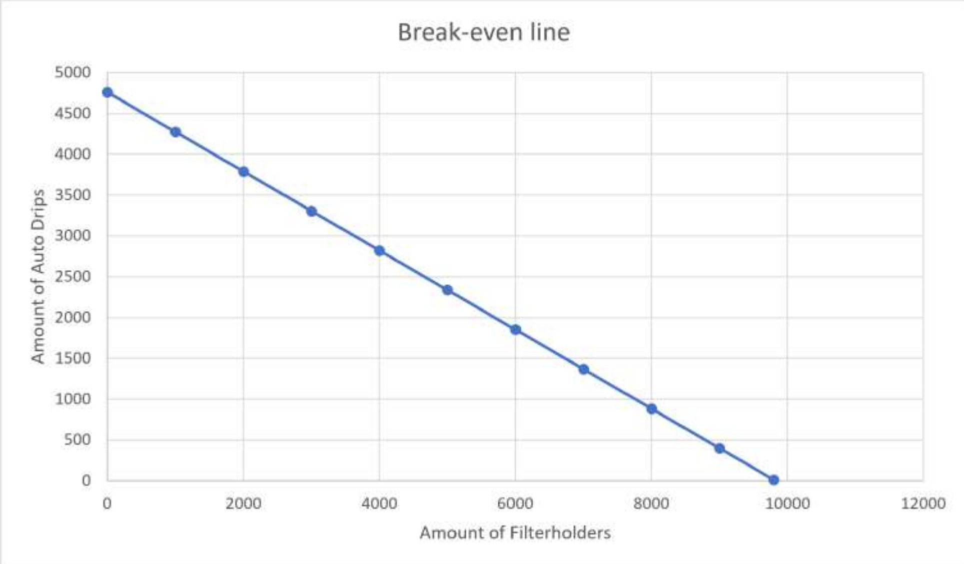


Figure 8.18: The break-even line is what determines the profitability of the project. The horizontal axis is the number of filter holders sold, and the vertical axis is the number of Auto Drip sold. The amounts of both can be plotted on the chart; if it is above the line, the project is profitable; if it is below, it is not yet profitable.

9

Auto Drip

This chapter presents the final Auto Drip concept in its entirety. It details the product's overarching purpose, step-by-step usage instructions, and provides a comprehensive breakdown of its component design and intended manufacturing processes.

9.1 What Is the Auto Drip?

The Auto Drip is an accessory for the Trangia 25- and 27-stoves that transforms a regular stove into a drip coffee maker, as shown in Fig. 9.2. It brews drip coffee the same way a traditional drip coffee machine does: by automatically pouring hot water over a filter with coffee grounds. The Auto Drip prototype can brew up to 0.9 litres of coffee in roughly 18 minutes. As shown in Fig. 9.1, it is designed to work with and pack into both the 25- and 27-stove, and therefore takes little to no extra space when packed. Being entirely made out of metal, it is both durable and surprisingly light, weighing only 104 grams. The Auto Drip can be competitively priced at 600 SEK, resulting in a profit margin of 0.25 for Trangia.

Figure 9.1: Left: The final prototype of the Auto Drip. Right: A rendered picture of the final concept of the Auto Drip.

Figure 9.2: Left: Auto Drip mounted in the larger 25 Trangia stove. Right: Auto Drip mounted in the smaller 27 Trangia stove.

The Auto Drip focuses on meeting the needs of the less-experienced outdoor demographic while still satisfying the demands of Trangia's core customers, who are generally more avid hikers. The Swedish market is dominated by at-home drip coffee, and the Auto Drip brings its convenience and flavour profile to the outdoor segment.

The Auto Drip's filter holder can also be used as a standalone pour-over coffee solution, as shown in Fig. 9.3, where hot water is poured over the coffee grounds and runs through the filter into a desired receiving vessel. Pour-over coffee takes roughly 3-4 minutes per cup, depending on how quickly the water is poured. The filter holder can be placed on the edges of any vessel with a diameter between 60 mm and 150 mm. It is designed to hold a standard coffee filter type 1×4, but is compatible with other types as well. The filter holder alone weighs about 50 grams and can be easily packed thanks to its flat-pack design. The filter holder can be competitively priced at 300 SEK, resulting in a profit margin of 0.30 for Trangia.

The filter holder is aimed first at customers who value simplicity, consistency, and a cosy process, but it also meets the needs of coffee connoisseurs who want more control over the brewing process.

Figure 9.3: The filter holder mounted on the two Trangia kettle sizes and the newly launched Trangia Nest mug.

9.2 How Is It Used?

This section provides a practical guide to the Auto Drip experience, illustrating the intended process flows for assembly, brewing, disassembly, packing, and its alternative use as a manual pour-over device.

9.2.1 Assembly & Brewing

Using the Auto Drip requires assembling and lighting a Trangia stove and placing a pot of water on it. Then the Auto Drip itself can be assembled onto the stove. There are several ways to assemble the product, but the intended process flow is shown in Fig. 9.4.

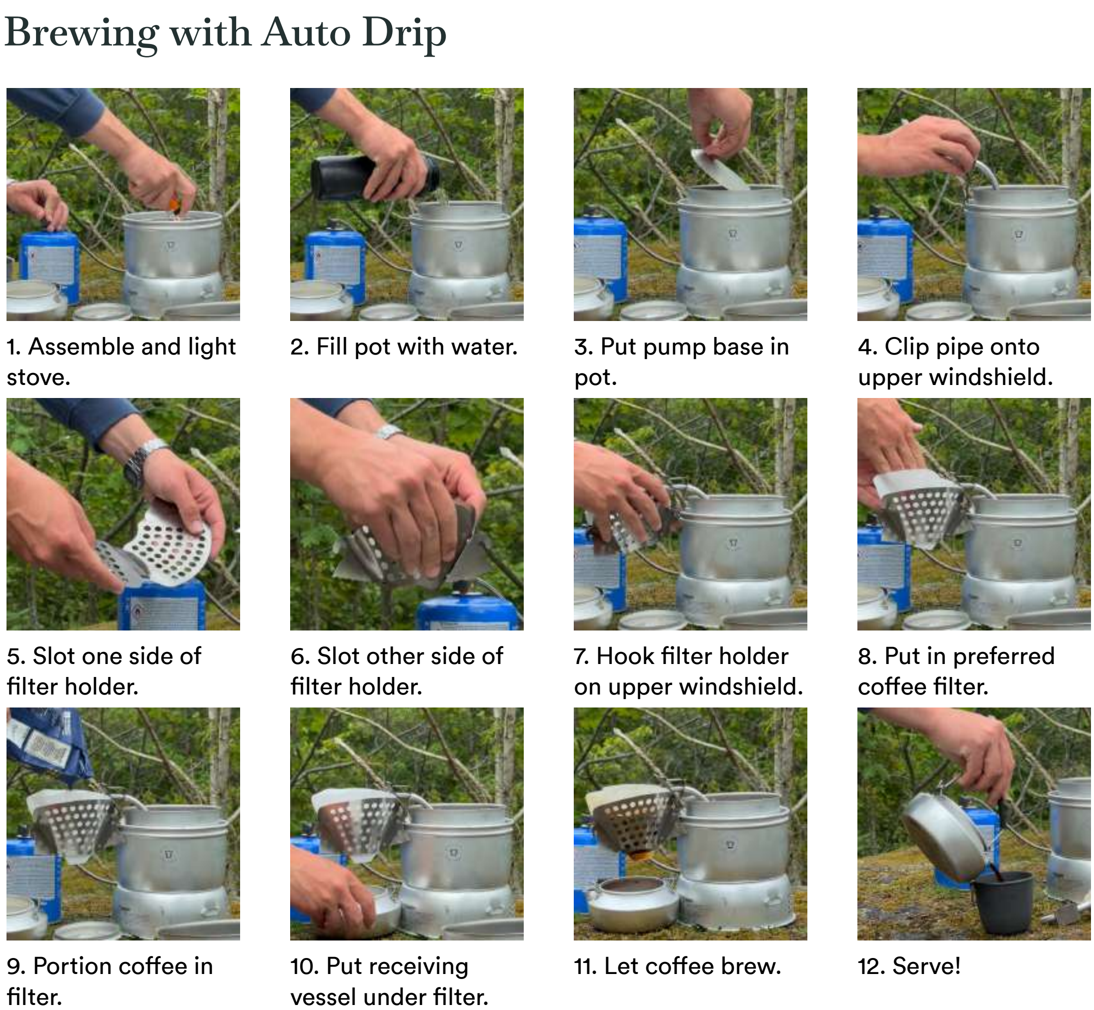


Figure 9.4: Process description for assembling and brewing coffee using the Auto Drip.

9.2.2 Disassembly & Packing

As for the assembly, there are several feasible ways to disassemble and pack, one of which is exemplified in Fig. 9.5. Cleaning the Auto Drip is very simple and includes only the optional step of rinsing the filter holder.

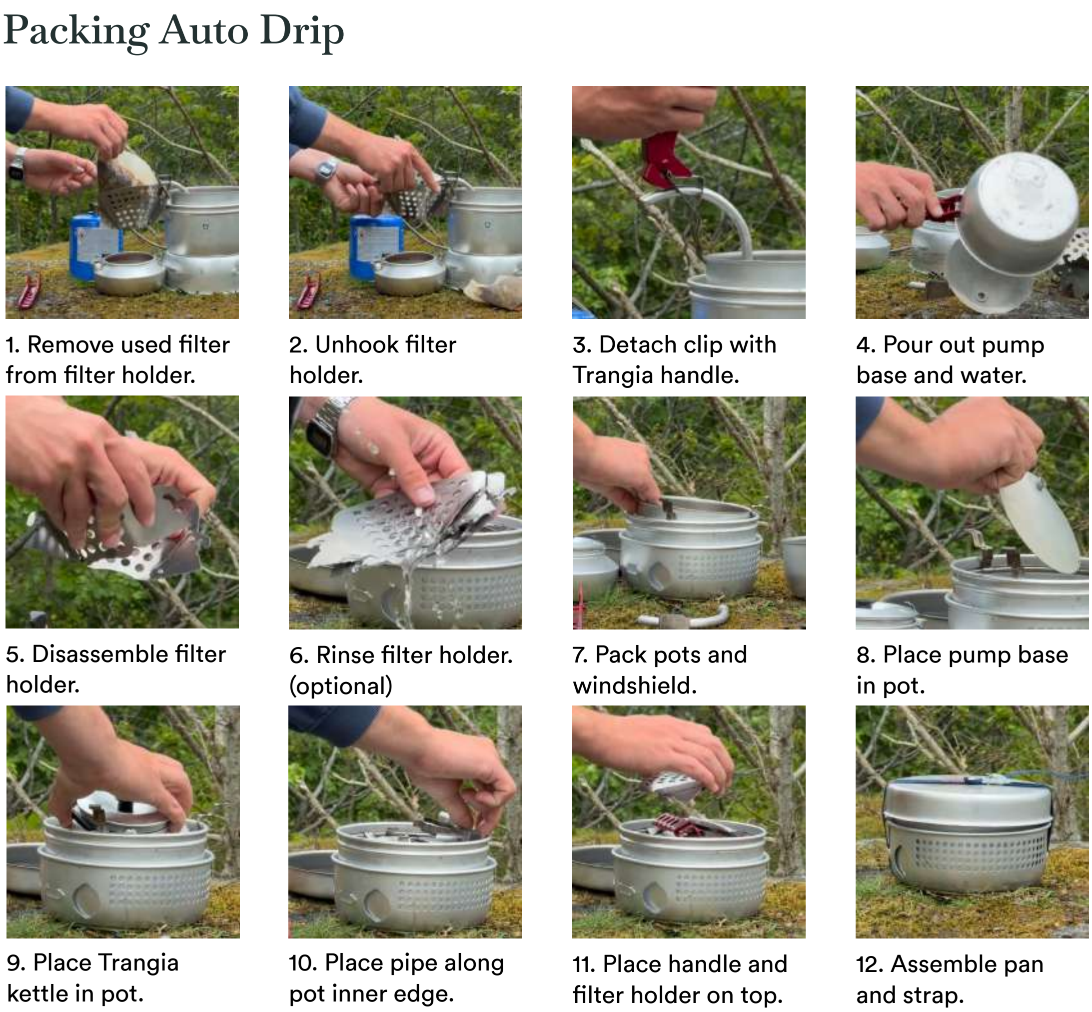


Figure 9.5: Process description for disassembling and packing the Auto Drip.

9.2.3 Pour-Over

When using the filter holder on its own for pour-over coffee, the assembly and disassembly processes are essentially the same as steps 5 and 6 in Fig. 9.4 and Fig. 9.5. The filter holder can then be placed on a receiving vessel or hooked onto the windshield. For the brewing step, pouring is done manually rather than having hot water pumped through the filter automatically.

9.3 Part Design and Manufacturing

The Auto Drip consists of only five parts (see Fig. 9.6), four of which are unique. In this section, the functions of the parts, their materials, and the intended manufacturing techniques are detailed.

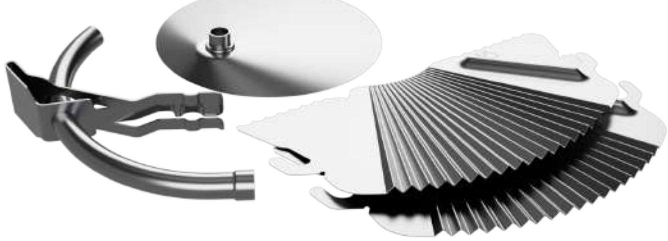


Figure 9.6: The parts that make up the Auto Drip.

9.3.1 Pump Base

The pump base of the Auto Drip sits against the bottom of the pot, catching the steam that is generated from the heat to push water up the pipe. Dimensioned to fit all pots of both stoves, the conical shape helps direct steam and water to the pipe inlet. It connects to the pipe via a small protrusion riveted to the plate (see Fig. 9.7).

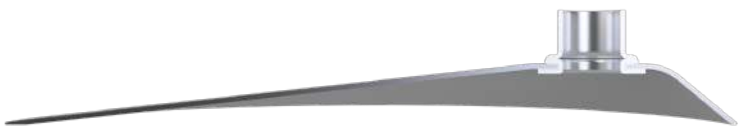


Figure 9.7: The pump base in a cross-section view showing how the small protrusion is riveted.

The pump base is designed to be manufactured from the scrap material created when cutting the hole in the upper windshield of the Trangia 25 stove. Using Trangia's existing hydraulic press, the pump base can be drawn from the scrap piece of aluminium sheet, shaped, and the hole cut in a single operation. The protruding pipe can then be added in a semi-automatic step, where it is riveted in place by deforming both sides of the protrusion, permanently mounting it to the base plate.

9.3.2 Pipe

The pipe (see Fig. 9.8) transports water from the pump base to the filter holder and serves as the structural element that presses the pump base down onto the pot bottom. The pipe is connected to the pump base at one end and is permanently attached to the clip, which holds it securely to the stove.

Figure 9.8: The pipe before the clip is permanently mounted on it.

The pipe is made of a standard 10×1 mm aluminium pipe with a large bend, making it extremely easy to manufacture using a CNC pipe-bending machine. As Trangia does not have the necessary equipment, outsourcing the manufacturing of this part would be reasonable. Depending on the subcontractor's machine capabilities, the enlarged end of the pipe can be formed directly on the machine or added in a separate end-forming step.

9.3.3 Clip

The clip secures the pipe and pump base to the rest of the stove by clamping onto the upper windshield rim (see left side of Fig. 9.9). It is designed to be gripped with the Trangia handle for easy mounting and dismounting on the windshield, even when hot (see right side of Fig. 9.9).

Figure 9.9: Left: How the clip secures to the upper windshield. Right: How the clip can be gripped using the Trangia handle.

Made from stainless steel sheet, the clip can be manufactured in-house using Trangia's progressive die. New tooling must be developed and manufactured externally. The clip can be secured to the pipe in a semi-automatic step by pressing the clip's sides into the pipe, locking it in place.

9.3.4 Filter holder

The filter holder holds a paper or an infinity coffee filter, which in turn holds the coffee grounds. The filter holder is made of two identical pieces of stainless steel sheet (see left side of Fig. 9.10) that slot together to form the conical filter holder (see right side of Fig. 9.10). Louvres are stamped into the parts to hold the conical shape when assembled. It hooks onto the edge of the Trangia stove upper windshield at the same place as the clip. The ridges on the filter holder are designed to reduce the material's stiffness, increase flow, and insulate the coffee during brewing.

The filter holder is designed to be manufactured similarly to Trangia's current product, the Trangia Triangle. That is, cut and shaped from 0,3 mm stainless steel sheet using Trangia's progressive die. The tooling must be developed and manufactured externally.

Figure 9.10: Right: the filter holder in its flat position. Left: Render showing how the two parts slot into each other to form the conical shape.

10

Discussion

Reflecting on the development process, this chapter critically evaluates the Auto Drip's performance and the project's methodology. It also addresses ethical considerations and proposes future refinements to the product.

10.1 Project Review

The overarching aim of this project was to develop a user-centred coffee brewing solution that enriches the outdoor coffee experience while respecting Trangia's heritage. Viewed broadly, the project successfully meets modern Swedish coffee consumption habits, aligns with Trangia's identified company values, and covers key user needs. By prioritising the identified user segments, "The Providers" and "The Ritualists", the resulting Auto Drip concept successfully caters to users who value reliability, shareable coffee volumes, and a stimulating yet hands-off brewing process.
The project's focus on early, frequent prototyping and testing required the design process to respect manufacturing and compatibility constraints. This resulted in a final concept with high manufacturing feasibility and strict backwards compatibility, nesting within both the existing Trangia 25 and 27 stove systems. From a production standpoint, the design aligns closely with Trangia's core sheet-metal forming capabilities, yielding a robust, lightweight product that requires relatively low tooling investments.

10.2 Methodology

The process established during the project's planning phase aimed to methodically go through each step of a classic product development project, resulting in a commercially viable product. A lot of time and energy were invested in understanding the problem, competitors, and users. The broad knowledge gained early helped guide product development, from ideation to concept elimination. The time spent on the pre-study meaningfully changed the project's trajectory, making it highly valuable.

The project methodology also maintained a wide, exploratory approach to encourage untested and innovative ideas. This free approach led to the discovery of many flawed yet innovative ways of brewing coffee (especially the centrifugal coffee brewer; see Section 7.2.1). The combination of maintaining a wide idea space while focusing on evaluation through physical testing meant that many hours were spent evaluating promising subsolutions that ultimately did not contribute to the final concept. However, many unexpected physical, thermal, or spatial issues often emerged in the process, which helped inform the design space regardless of the specific subsolutions' viability. Ultimately, the chosen development approach succeeded in quickly identifying and eliminating unworkable concepts while also revealing unexpected design obstacles that might otherwise have been missed.

With a more streamlined product development process and a reduced focus on exploration, more time would have been available for the later stages of product development. This would likely have led to a final prototype with better performance and a higher degree of optimisation. On the other hand, redistributing time to the later stages would come at the expense of the earlier stages, likely resulting in a less thorough final concept and less knowledge gained.

10.3 Ethical Concerns

The main ethical consideration of the product is that it encourages coffee consumption. Coffee is a problematic commodity in several ways. Growing and producing coffee is, in general, a land and energy-intensive task. The effects of coffee production on the climate and people vary widely from country to country and farm to farm. The spectrum ranges from slave labour in deforested rainforest to ethically produced, carbon-negative coffee. Coffee has a CO_2 equivalent of about 5kg CO_2 per kg coffee beans. This translates to about 50 grams equivalent CO_2 per cup. To put this into perspective, tea has about half the amount of CO_2 equivalent per cup, and milk has about 4 times more CO_2 equivalent per cup (Eneroth et al., 2022).
Coffee is not strictly necessary and is harmful to the planet and, in many cases, to farmers. It can, therefore, be unethical to promote its consumption to some degree. The product might not increase coffee consumption, but it reinforces the culture of coffee drinking and, therefore, the problems it brings.

Promoting outdoor coffee brewing will lead to more trash being disposed of in nature. Almost all the participants in the interviews said they have disposed of coffee grounds directly in nature before, and the Auto Drip does not address this in any way. The Auto Drip's use of paper filters might have exacerbated the problem, as the risk of discarded paper filters entering the environment is now higher. While both paper

and spent coffee grounds are highly biodegradable, littering is unsightly, and large amounts in a specific area (for example, at a campsite or along a high-traffic trail) can attract animals and negatively affect the environment due to coffee's low pH.
While the Auto Drip as a product does not cause more littering than any other, it does not address the problem in any way.

10.4 Auto Drip Challenges

While the final Auto Drip prototype successfully demonstrated the viability of an automated outdoor coffee brewer, prototype testing also revealed several functional issues that require further adjustment. These challenges primarily relate to the resulting coffee temperature, the complexity of physical assembly, and the water-to-coffee efficiency. For all the specific problems and design flaws discussed in this section, corresponding viable solutions have been formulated. These suggested solutions are presented in Section 10.5.

The most obvious problem identified during prototype testing was the low temperature of the coffee served. In optimal weather conditions, the Auto Drip produced a coffee temperature of 50°C (see Fig. 8.12). This result indicates that the solution is insufficient for delivering warm coffee in harsher outdoor environments. Based on temperature readings, two main contributing factors are: Droplets exposed to air during the brewing process, which cool rapidly due to their high surface-area-to-volume ratio. The filter holder and coffee kettle, which come into contact with the coffee and are both made of highly conductive materials, quickly transfer heat away from the liquid.

Another identified problem is the assembly of the prototype, most notably the filter holder. The filter holder prototype is quite stiff, and bending it into shape for assembly can be difficult because it requires both force and fine motor skills. The assembly order of the filter holder also proved difficult due to the prototype's unclear front and back sides.

The rest of the assembly was proven quite intuitive, but starting the stove was a problem. When the Auto Drip is mounted, the burner can not be reached for ignition. The entire upper section of the stove must be removed to access the burner, which is somewhat inconvenient. Alternatively, the burner can be ignited before assembling the Auto Drip parts on the stove, but this increases the risk of the user being burnt.

Removing the filter holder and clip has also proven challenging because the tight

space between them causes them to bind together. Removing the clip first is the easiest way to do it, but it sometimes requires a little force; the stove's relatively light weight makes this particularly difficult.
One of the most important aspects of brewing coffee is the coffee-to-water weight ratio. The current Auto Drip solution does not address this in any way. Furthermore, the amount of water added to the pot is not the same as the amount that will be poured over the coffee grounds. This is because the pump stops working when the water level falls too low, saving the pot from going dry. To get a precise water-to-coffee ratio, the residual water in the pot needs to be accounted for.

The water-to-coffee yield is also notably low, as most of the water cannot be pumped into the filter, but also high evaporation losses. The water evaporates during the brewing process, both in the filter and as it drips out. The Auto Drip is therefore not ideal in situations with low water amounts.

The manufacturing method of the filter holder is ambiguous. Adding ridges to the coffee filter poses manufacturing challenges. Stainless steel work-hardens and is therefore more difficult to form than the other metals. Prototype testing shows that it is possible to make the ridges one by one using a manual sheet metal bender. To form the ridges one by one in a progressive die, the tool would need to be very long. The other method of making them all at once is problematic because of the work hardening caused by stretching that much material. The work hardening could result in the part becoming stiffer than before or brittle, leading to cracking.

10.5 Recommendations for Future Work

As stated earlier in the discussion, the current Auto Drip concept does not meet all requirements. To improve the concept, minor modifications and refinements are necessary. Below are some proposed solutions to the identified challenges.

10.5.1 Cold Coffee

As described before (see Section 10.4), the main problem with the prototype is the resulting coffee temperature. By reducing the time water/coffee remains as droplets and by insulating the filter holder and receiving vessel (see Fig. 10.1), the resulting coffee temperature can be increased. Not all the improvements might be necessary, but testing them all would hopefully yield at least one configuration that brews hotter coffee.

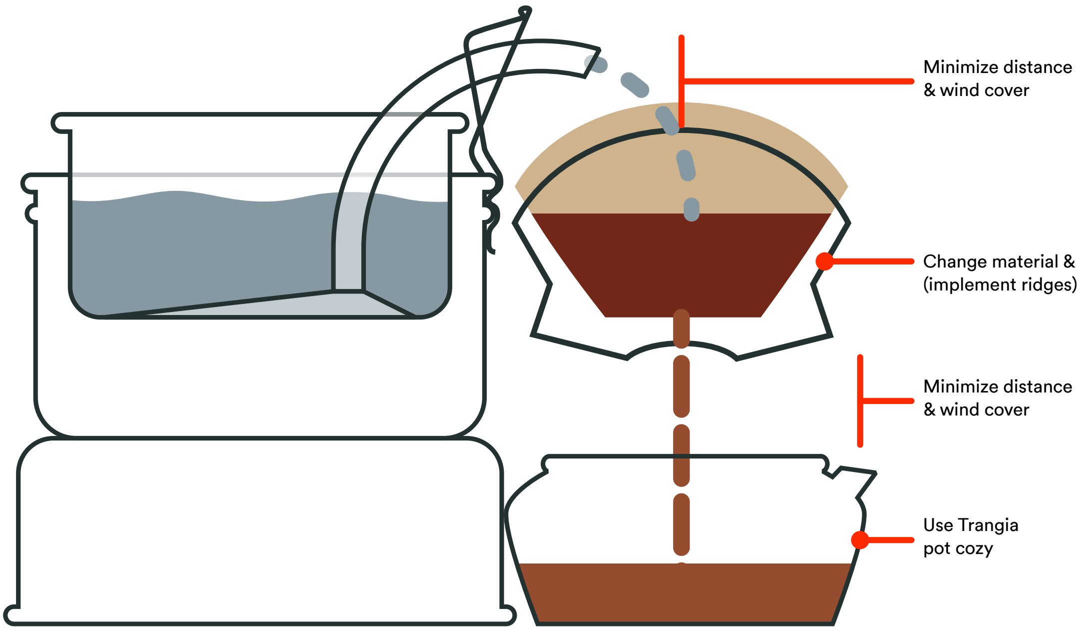


Figure 10.1: Illustration of changes to be made to decrease observed temperature losses in Auto Drip prototype testing.

One design change that might preserve the coffee's heat through insulation is the use of ridges in the filter holder, as described in the final concept but not yet implemented in the prototype. Reducing the filter-to-filter holder contact area will likely significantly reduce heat dissipation. Should the change not be sufficient, switching the main filter holder material to a heat-resistant plastic with integrated metal hooks could be an alternative. This also reduces uncertainties in the manufacturing of the ridges as injection moulding is a less limiting process.

Having a wind cover stretching down from the filter holder could help insulate the droplets and is more easily implemented in a plastic variant. In the case of adoption, the depth of the wind cover needs to be assessed to ensure it does not interfere with the use of the filter holder on its own in shallower vessels. Simply having a wind cover on the top of the filter also helps with insulation, but it also has to be compatible with a manual pour-over process.

10.5.2 Water to Coffee Yield

To increase the amount of water converted into coffee, evaporation losses need to be reduced. The proposed addition of wind protection in Fig. 10.1 would lower the evaporation in the brewing section. Having a lid over the pot that boils the water would probably also reduce evaporation losses. Currently, the frying pan can be used in a suboptimal way, but the pipe hinders it from covering the entire pot opening. The multi-disc fits better, but it is at risk of melting because it is made out of plastic.

10.5.3 Complicated Assembly

To make the disassembly easier, the filter holder and the pipe clip need to be modified to reduce the interference. This can be done by lowering the filter holder relative to the mounting point so that the two parts overlap less.
Another improvement would be to have the small protrusion on the pump base guide the pipe's angle. Currently, the pipe can be mounted at any angle on the pump base, making it possible to assemble the product incorrectly. Having the protrusion and pipe not completely round, for example, oval or square, could force alignment and prevent this failure mode.

10.5.4 Coffee Portioning

For more exact measuring of coffee, a convenient measuring system needs to be developed. It has to be in conjunction with the water portioning and work for both the 25 and 27 stoves. Possible solutions to explore include measuring in the pot lid, adding measuring lines in the filter holder, and measuring with the pump base. All these tentative solutions need to be explored and evaluated to ensure coffee can be portioned correctly.

10.5.5 Flow Rate and Backfeeding

The current bottlenecks in the Auto Drip are the filter holder and the coffee grounds. The water does not percolate fast enough through the coffee grounds because of the filter holder and filters a large contact area. To increase the flow rate, ridges would probably help, as mentioned in Section 8.2.4. Increasing the flow rate through the filter would also help prevent backfeeding (where coffee is drawn from the filter holder back into the pot). Backfeeding occurred when the water level in the filter holder was too high, and the pipe outlet came into contact with the water. Backfeeding can likely be mitigated by drilling a small hole into the pipe near its exit. This modification would break any vacuum that forms inside the pipe during the brewing process.

11

Conclusions

This Master's thesis project has led to the successful development of Auto Drip, a new outdoor coffee-brewing solution tailored to Trangia's ecosystem. Based on the project's findings, several key conclusions can be drawn regarding user needs, technical integration, and brand alignment. These conclusions answer the guiding questions established at the project's outset.

First, "The Providers" and "The Ritualists" were identified as the primary target segments for a Trangia coffee accessory. To meet these users' expectations, an outdoor brewer must reliably produce a great-tasting cup of coffee that aligns with modern coffee preferences, while also being durable, easy to clean and easy to use. By automating the pouring process through a mechanical percolation system, the solution frees the user's hands, making outdoor brewing significantly more practical.

Second, from a structural and technical perspective, the Auto Drip concept is fully compatible with both the Trangia 25 and 27 stove series. It respects the existing packing constraints, nesting completely within the standard stove configurations alongside the kettle without increasing bulk. Furthermore, the product's geometry is optimised for Trangia's existing manufacturing capabilities. By using mostly sheet-metal forming, a robust design with low tooling and machine investments is ensured.

Finally, the project proves that a new accessory can bridge modern coffee consumption habits with Trangia's traditional brand values. By relying entirely on a heat-driven pump system, Auto Drip delivers a drip coffee-style brew while maintaining the rugged simplicity, reliability, and lifelong utility that define the Trangia ethos.

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A

Appendix

This appendix contains supplementary materials and extended data from the project, including detailed field-testing analyses, persona profiles, KJ analysis boards, and comprehensive requirements specifications.

A.1 Field Testing Analysis and Personas

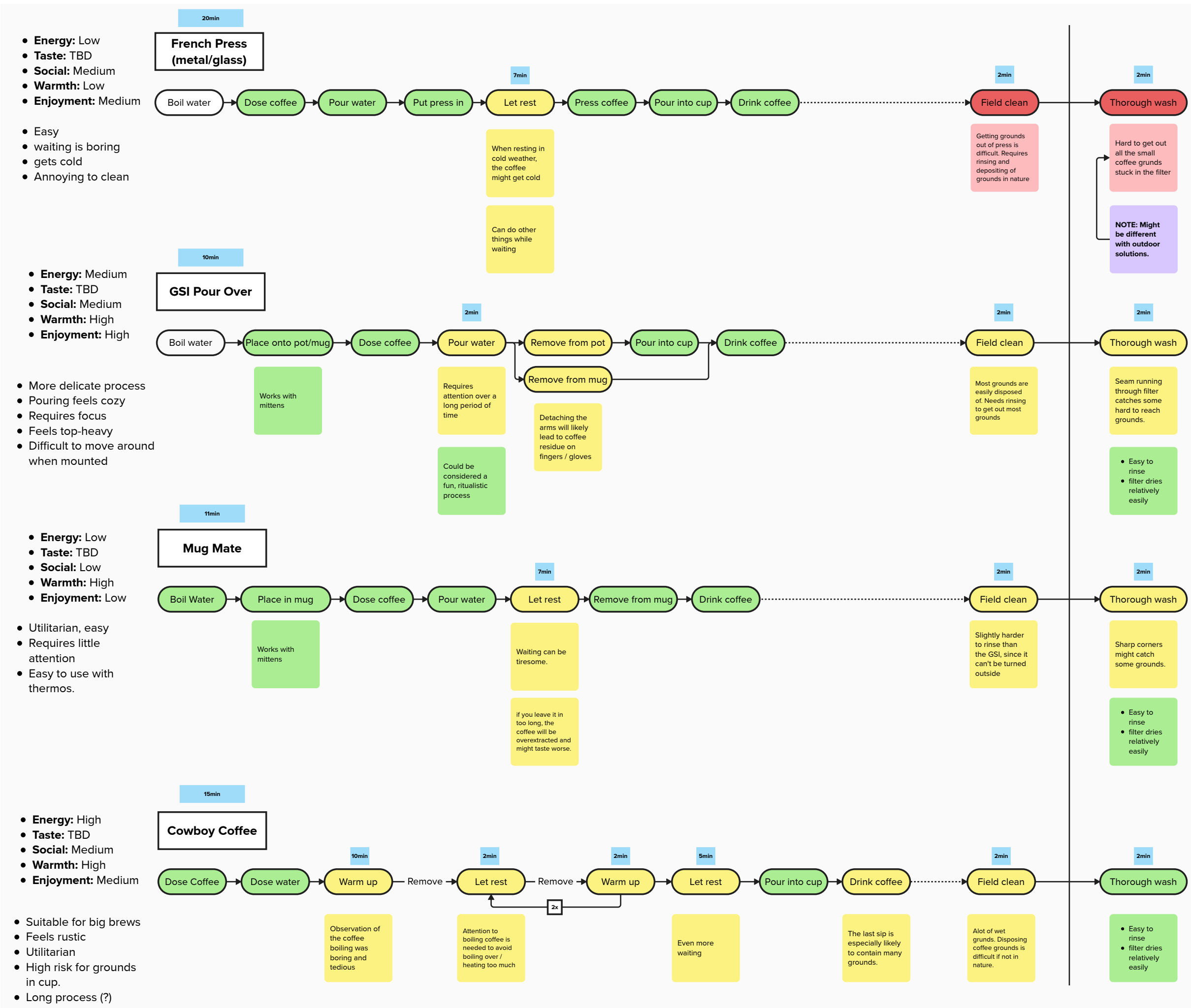

Figure A.1: The resulting analysis of the processes from the field testing of current market solutions.

	"The Parent"	**"The Ultralighter"**	**"The Old-timer"**
	Johanna	David	Torbjörn
			
	"I want the cozy feeling of home, just outdoors."	"I'm counting grams, not looking for a barista."	"Plastic breaks. Give me soot, fire, and steel."
Age	25-40	20-35	45+
Profession	HR at medum size company	Sales manager at tech start-up	Industrial technichian
Family situation	Married, two kids	Single, large friend group	Married, kids have moved out
Living situation	Villa in the suburbs	Apartment in hip area	Moved out to the countryside
Brand preference	Fjällräven, Apple, Ica Maxi, Volvo family car	Mountain Hardwear, Skalmo, Garmin, Fixie bike	Hunting flannel shirt, Trangia, Military Surplus, Primus, Saab
Brand values	Comfortable, Easy to use	Bespoke / nische, Cool-factor, Cutting edge performance	Traditional, Robust, Simple
Hobbies	Full-time parent. Group exercise every Tuesday afternoon.	Catching new trends, craft beer with friends, bouldering	Cooking, campfires, home renovation
Economy	Medium income, High spending.	Medium income, Medium spending.	High income, low spending.
Nature objectives	Calm, get the kids out in nature.	Conquer, achievements, bragging rights.	Calm, tranquil, get some exercise, fresh air.
Coffee objectives	Take a break, get through the day. Warm and tasty.	Energy-boost, social.	Having a cosy moment with a warm beverage.
Coffee per brew	2-4 cups	1-2 cups	1 cup
Gear interest	Very low	Very high	High
	Ease of use	Low weight	Reliable
	Comfortability	Compact	Robust
	Aesthetical appeal	Fast	Simple
	Low cost	Efficient	Traditional
	Tasty coffee	High tech	Warm coffee
		Strong coffee	

Figure A.2: Persona display. Images generated using generative AI (Google, 2026)

	"The Hiker"	"The Coffee Nerd"	"The Scout Leader"
	Kajsa	Robert	Magnus
			
	"Brewing slow lets me really enjoy the view."	"Check this crema. Absolute extraction perfection."	"It's not about taste, it's about warming the group."
Background	20-40	25-50	35-55
	Middle-school teacher	Accountant at large firm	Teacher / Youth Leader
	Sambo + dog	Sambo	Married, 3 kids
	Renovated cabin in the woods	Apartment in the city	House with garden
	Klättermusen, Second Hand, Old phone, 2000s Toyota	Uniqlo, MQ, Apple, Public transit	Trangia, Haglöfs, Primus, Woolpower
	Functional, Sustainable, Quality	Aesthetic, Quality, Status	Safety, Durability, Tradition
	Walking the dog, gardening, hiking, and pickling	Coffee, furniture / design	Scouting, Hiking, Teaching
Attributes	Medium income, low spending.	Medium income, Medium spending.	Medium income, Low spending.
	Experience, being present in the moment.	Only there if invited by friends.	Education, Leadership, Community.
	Having a cosy moment with a warm beverage.	Fine tasting - a gastronomical experience.	Warmth, Social cohesion, Energy for the group.
	2-4 cups	1 cup	Alot (1L+)
	Medium	High	Medium
Needs	Reliable	Aesthetical appeal	Safety
	Robust	Unique	High Volume
	Simple	Precise	Robust
	Compact	High quality coffee	Easy to clean
	Low weight		Stackable
	Low carbon footprint		Reliable
	Warm coffee		Cost-effective

A.2 KJ Analysis

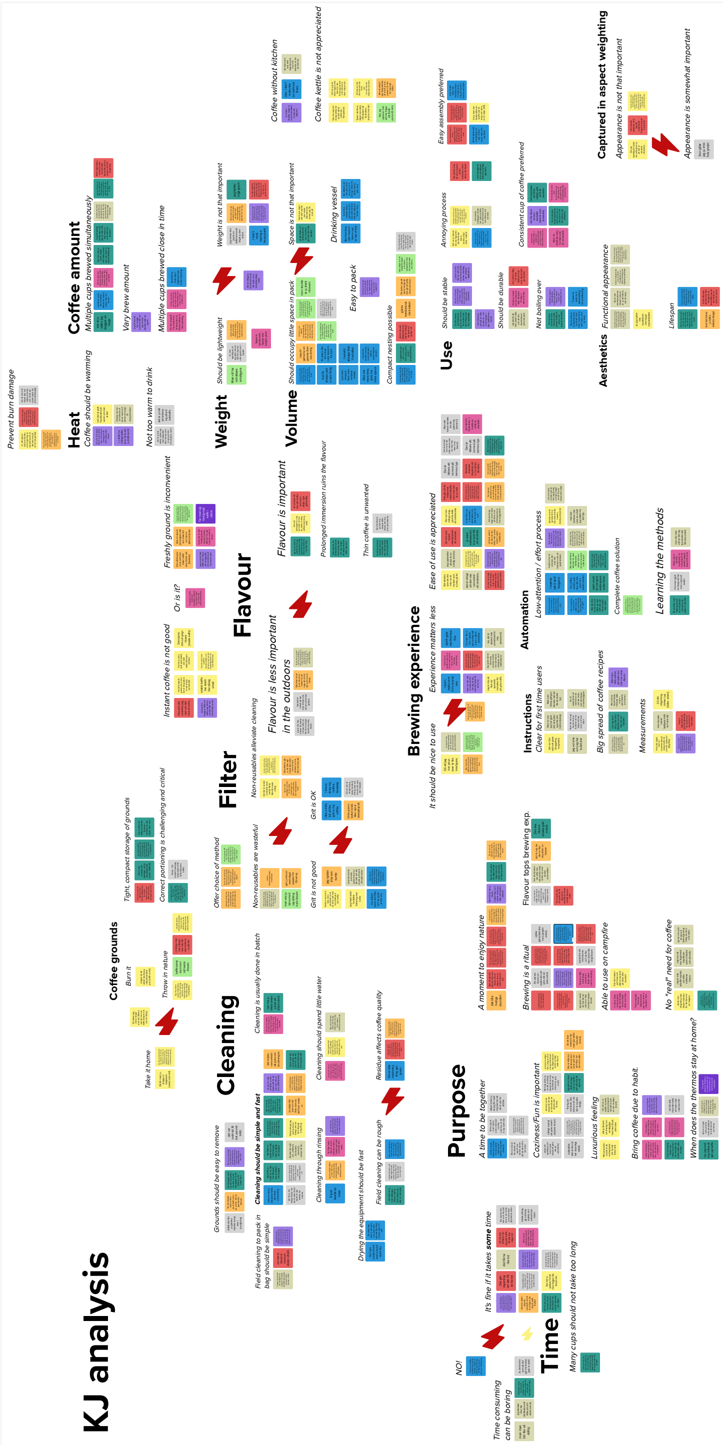

Figure A.3: Full KJ analysis board with clusters of quotes.

A.3 User Needs List and Requirement Specification

Need	D/W	Category	SH 1	SH 2
Form follows function	D	Aesthetics	Primary	Customers
Looks good through wear and tear	D	Aesthetics	Primary	Extended life
Tailorable method	W	Brewing	Primary	
Requires little surveillance during brewing	D	Brewing	Primary	
Requires little input during brewing	D	Brewing	Primary	
Does not impede cooking	D	Brewing	Secondary	Primary
Brewing process is a sensory delight	W	Brewing	Primary	Secondary
Brewing is reasonably fast	D	Brewing	Primary	Secondary
Field cleaning is quick	D	Cleaning	Primary	
Field cleaning is simple	D	Cleaning	Primary	
Deep cleaning is quick	D	Cleaning	Primary	
Deep cleaning is simple	D	Cleaning	Primary	
Cleaning spends little water	D	Cleaning	Primary	Secondary
Low coffee residue after cleaning	D	Cleaning	Primary	
Dries quickly	W	Cleaning	Primary	
Spent grounds can be stored	W	Cleaning	Tertiary	Environment
Spent grounds can be separated	W	Cleaning	Primary	
Batch cleaning compatible	W	Cleaning	Primary	Secondary
Can be used with campfire	W	Compatibility	Primary	
Can be used on stove top	W	Compatibility	Primary	
Can be used by itself	W	Compatibility	Primary	
Is stable on uneven ground	D	Stability	Primary	
Does not detract from nature experience	D	Brewing	Primary	Secondary
Is durable	D	Lifespan	Primary	Environment
Is relatively lightweight	D	Packability	Primary	
Occupies little space	D	Packability	Primary	
Minimizes dead space	W	Packability	Primary	Secondary
Easy to pack in bag	D	Packability	Primary	
Can be packed with stove system	D	Packability	Primary	
Can be packed by itself	D	Packability	Primary	
Provides good storage of coffee grounds	W	Packability	Primary	Customers
Taste similar to drip coffee	W	Results	Primary	Secondary
Brewed coffee can be stored	W	Results	Primary	Secondary
Coffee is medium extracted	D	Results	Primary	Secondary
No grit in cup	W	Results	Primary	Secondary
Produces consistent results	D	Results	Primary	Secondary
Produces warm coffee	D	Results	Primary	
Prevents spillage	D	Safety	Primary	
Produces not to warm coffee	D	Safety	Primary	
Prevents burn damage	D	Safety	Primary	
Can produce multiple cups of coffee	D	Brewing capacity	Secondary	Primary
Can produce one cup of coffee	D	Brewing capacity	Primary	
Easy to assemble	D	Usability	Primary	
Few separable parts	D	Usability	Primary	
Easy to use	D	Usability	Primary	
Clear process	D	Usability	Primary	
Clear instructions	D	Usability	Primary	
Alleviates coffee portioning	D	Usability	Primary	
Alleviates water portioning	D	Usability	Primary	
Clear integration with mug	W	Usability	Lead users	
Easy to master	D	Usability	Primary	
No consumables neccessary	W	Waste	Primary	Environment

Chalmers	MSc. Thesis Project: Coffee Accessories with Trangia						
Agust Lindh & Rasmus Östman		Created: 2026-02-10					
	Criteria	**Target values**	**Results**	**D/W**	**Verification method**	**Reference**	**Comments**
1	**Performance**						
1.1	Max brewing time for 900 ml of coffee	15 min	18,5	D	Time Measurement		
1.2	Max possible amount of liquid in one brew	900 ml	~ 950 ml	D	Volume Measurement		
1.3	Max amount of coffee grounds in one brew	60 g	64 g	D	Weight Measurement		
1.4	Max weight of product	500 g	104 g	D	Weight Measurement		
1.5	Filter choice						
1.5.1	Reusable filter option	☑	☑	W	Design choice		
1.5.2	Standard disposable filter option	☑	☑	D	Design choice		
2	**Environment**						
2.1	Minimum working temperature	-20C	-	D	Material specs		Needs further testing
2.2	Works in strong winds	15m/s	-	D	Field test		Needs further testing
2.3	Stable usage on uneven ground	☑	☑	D	Prototype test		
3	**Coffee**						
3.1	Coffee brewing temperature	94-96 C	80-95 C	D	Thermometer		
3.2	Served coffee temperature	> 60 C	~ 50 C	D	Thermometer		
3.3	Taste profile	Similar to drip coffee	☑	D	Taste test		
3.4	Coffee quality	Similar to drip coffee	☑	D	Taste test		
3.5	Coffee clarity	Similar to drip coffee	☑	D	Visual inspection		
3.6	Can be used for tea	☑	☐	W	Prototype test		
4	**Lifetime**						
4.1	Holds up to regular use without deformation	☑	☑	D	Prototype test		
4.2	Lifetime without spare parts	20 years	☑	D	Estimation from BOM		
4.3	Lifetime with spare parts	infinite	☑	D	Estimation from BOM		
4.4	Maintenance interval						
4.4.1	Maintenance interval	None	☑	W	Estimation from BOM		
4.4.2	Maintenance interval	1 year	☑	D	Estimation from BOM		
5	**Cleanability**						

Figure A.4: Complete requirement list.

5.1	Time to clean after use	40 s		30 s		D	User Test (Stopwatch)	
5.2	Time to deep clean	120 s		90 s		D	User Test (Stopwatch)	
5.3	Ease of coffee disposal	Very convenient			☑	D	User Test	
6 Manufacturing								
6.1	Manufactured in Sweden		☑		☑	D	BOM	
6.2	Manufactured at Trangia in Trångsviken		☑		☑	W	BOM	Trangia
6.3	Degree of automation	high		high		D		
7 Material Origin								
7.1	Existing material at Trangia		☑		☑	W	BOM	Trangia
7.2	Swedish material		☑		☐	W	BOM	
8 Packability								
8.1	Fits inside specific series						Fit Test	
8.1.1	Fits inside Series 25		☑		☑	D	Fit Test	
8.1.2	Fits inside Series 27		☑		☑	D	Fit Test	
8.2	Noise level when carried	Low		Low		D	Shake test	
8.3	No damage of surrounding equipment when carried		☑		☑	D	Shake test	
9 Compatibility								
9.1	Compatible with Trangia pot gripper "Tamoj"		☑		☑	W	Prototype test	Trangia
9.2	Compatible with nest mug		☑		☑	D	Prototype test	
9.3	Compatible with kettles						Prototype test	
9.3.1	Kettle Size 0.6l		☑		☑	D	Prototype test	
9.3.2	Kettle Size 0.9l		☑		☑	D	Prototype test	
9.4	Compatible with Pots						Prototype test	
9.4.1	Pot Size 1.75l		☑		☑	D	Prototype test	
9.4.2	Pot Size 1.5l		☑		☑	D	Prototype test	
9.4.3	Pot Size 1l		☑		☑	D	Prototype test	
9.4.4	Pot Size T-cup (0.5l)		☑		☑	D	Prototype test	
9.5	Compatible with stoves						Prototype test	
9.5.1	Stove Series 25		☑		☑	D	Prototype test	
9.5.2	Stove Series 27		☑		☑	D	Prototype test	
9.5.3	Stove Series Mini		☑		☐	W	Prototype test	
9.5.4	Stove Series Triangle		☑		☐	W	Prototype test	
9.6	Compatible with burners						Prototype test	
9.6.1	Alcohol burner		☑		☑	D	Prototype test	

9.6.2	Gas burner		☑		☑	D	Prototype test		
10	**Trangia's Brand**								
10.1	In line with visual brand identity						Visual analysis	Trangia	
10.1.1	Design format analysis score	>10			14	W	DFA		
10.1.2	Fit into mood board		☑		☑	W	Visual analysis		
10.2	In line with Trangia's values								
10.2.1	Adheres to: Reliability		☑		☑	D	Qualitative review		
10.2.2	Adheres to: Sustainability		☑		☑	D	Qualitative review		
10.2.3	Adheres to: Tradition		☑		☑	D	Qualitative review		
10.2.4	Adheres to: Accessibility		☑		☑	D	Qualitative review		
11	**Food Safe**								
11.1	EU 1935/2004 Compatible		☑		☑	D	Estimation from BOM	EU Law	
11.1.1	Labeling Requirement "Wine glass & fork"		☑		☑	D	Visual check		
11.2	EU 2023/2006 Compatible		☑		☑	D	Estimation from BOM	EU Law	
12	**Recyclability**								
12.1	Amount of different materials	<5			3	W	BOM		
12.2	Separation of different materials possible			80%	☑	D	Disassembly test		
12.3	Recyclability	>50%			☑	D	Analysis		
12.4	Clear marking of materials		☑		☐	W	Visual check		
13	**Ergonomics**								
13.1	Possible to use without detailed instructions		☑	-		D	User test		Needs further testing
13.2	Possible to use with mittens		☑	-		W	User test		Needs further testing
13.3	Possible to use with one hand		☑	-		D	User test		Needs further testing
14	**Safety**								
14.1	Leakage / Spillage		☐		☐	D	User test		
14.2	Max temperature of contact areas	< 40 °C			☑	D	Thermometer		

A.4 Likert Scales

Hur var det att brygga kaffe med denna lösning?

Väldigt enkelt	Enkelt	Neutral	Svårt	Väldigt svårt
☐	☐	☐	☐	☐

Väldigt förvirrande	Förvirrande	Neutral	Intuitivt	Väldigt intuitivt
☐	☐	☐	☐	☐

Väldigt rofyllt	Rofyllt	Neutral	Tråkigt	Väldigt tråkigt
☐	☐	☐	☐	☐

Hur var det att rengöra produkten efter användning?

Väldigt enkelt	Enkelt	Neutral	Svårt	Väldigt svårt
☐	☐	☐	☐	☐

Hur smakade kaffet?

Väldigt äckligt	Äckligt	Neutral	Gott	Väldigt gott
☐	☐	☐	☐	☐

Hur upplever du produktens utformning?

Väldigt attraktiv	Attraktiv	Neutral	Oattraktiv	Väldigt oattraktiv
☐	☐	☐	☐	☐

Hur kändes produkten under bryggningsprocessen?

Väldigt pålitlig	Pålitlig	Neutral	Opålitlig	Väldigt opålitlig
☐	☐	☐	☐	☐

Figure A.5: Rating scales used to support discussion after testing four different existing products.

A.5 Process Flows

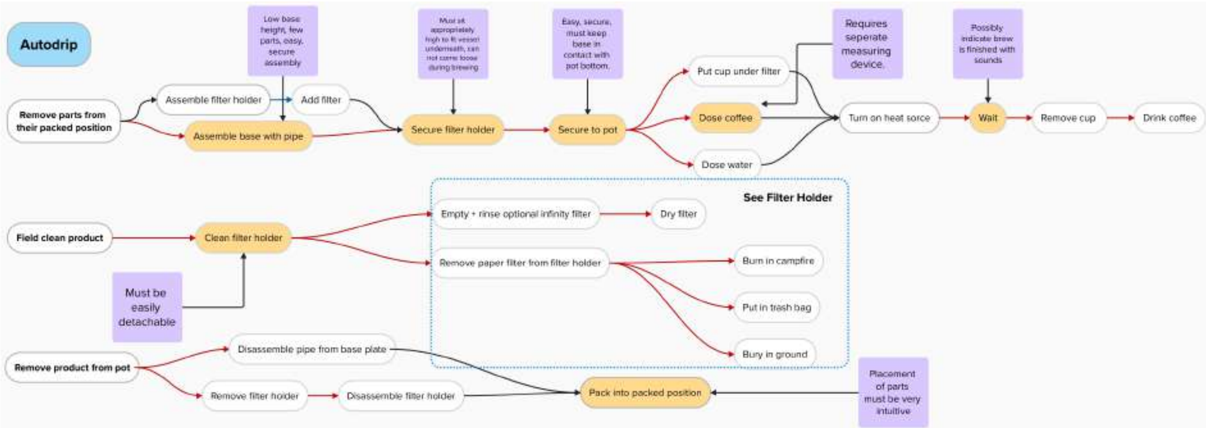

Figure A.6: Process flow with comments for the Auto Drip concept

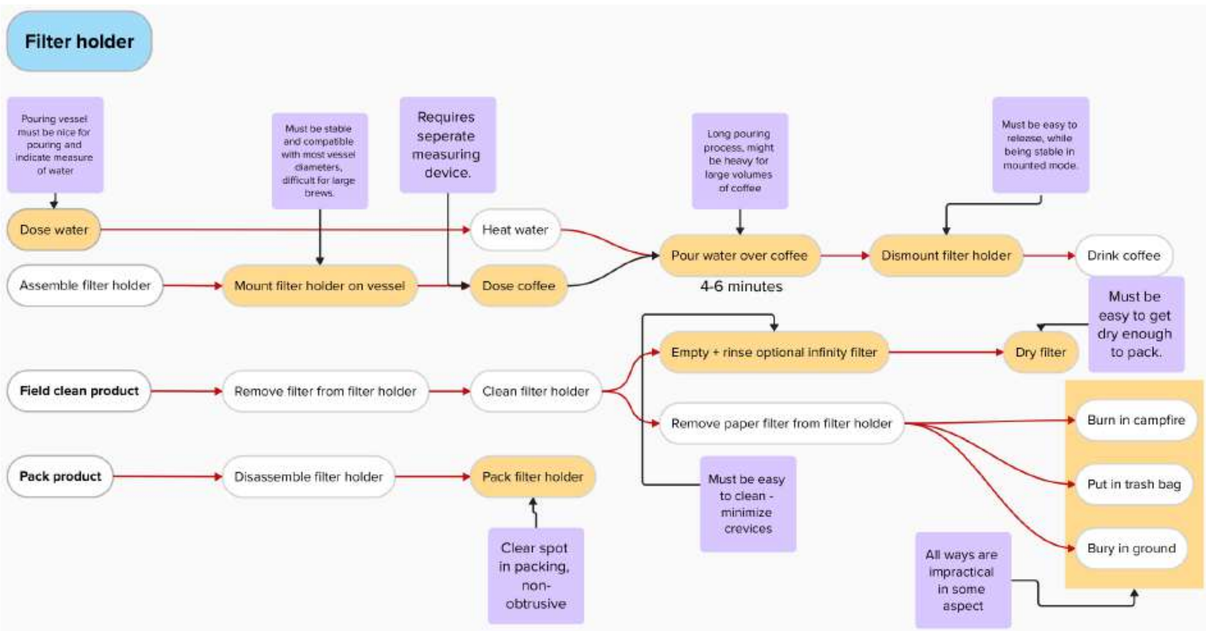

Figure A.7: Process flow with comments for the Filter Holder concept

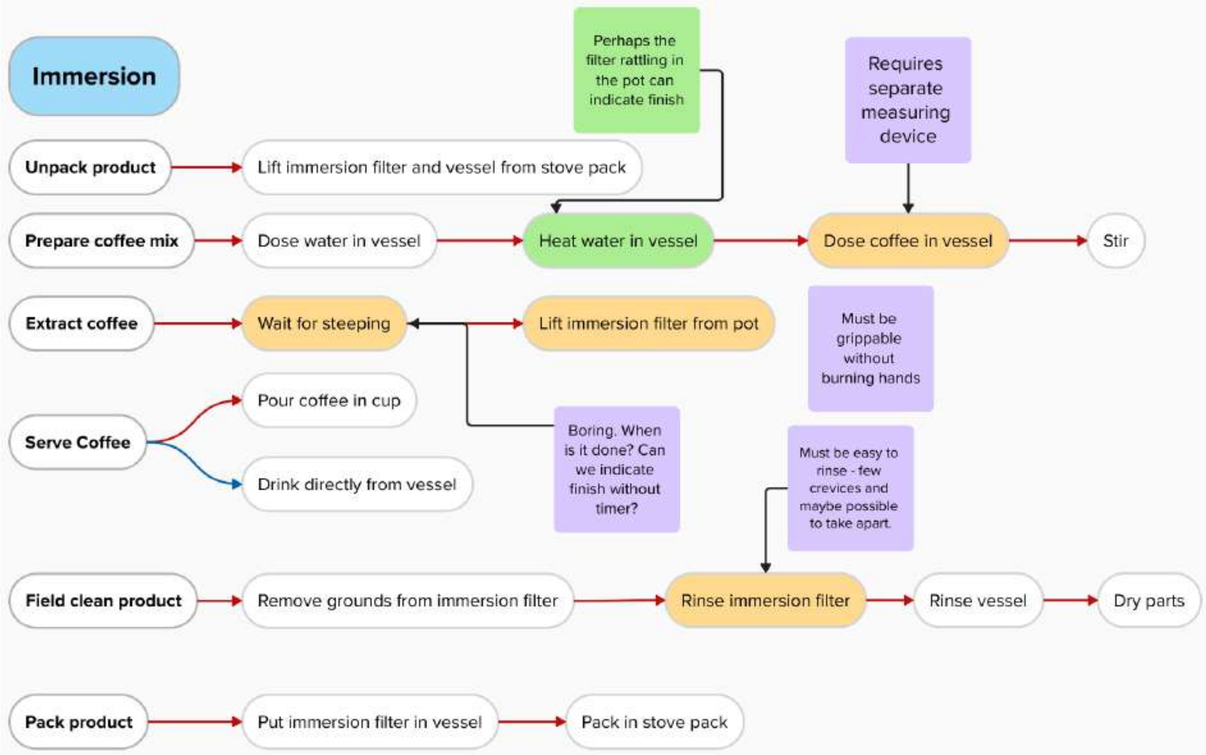

Figure A.8: Process flow with comments for the Immersion concept

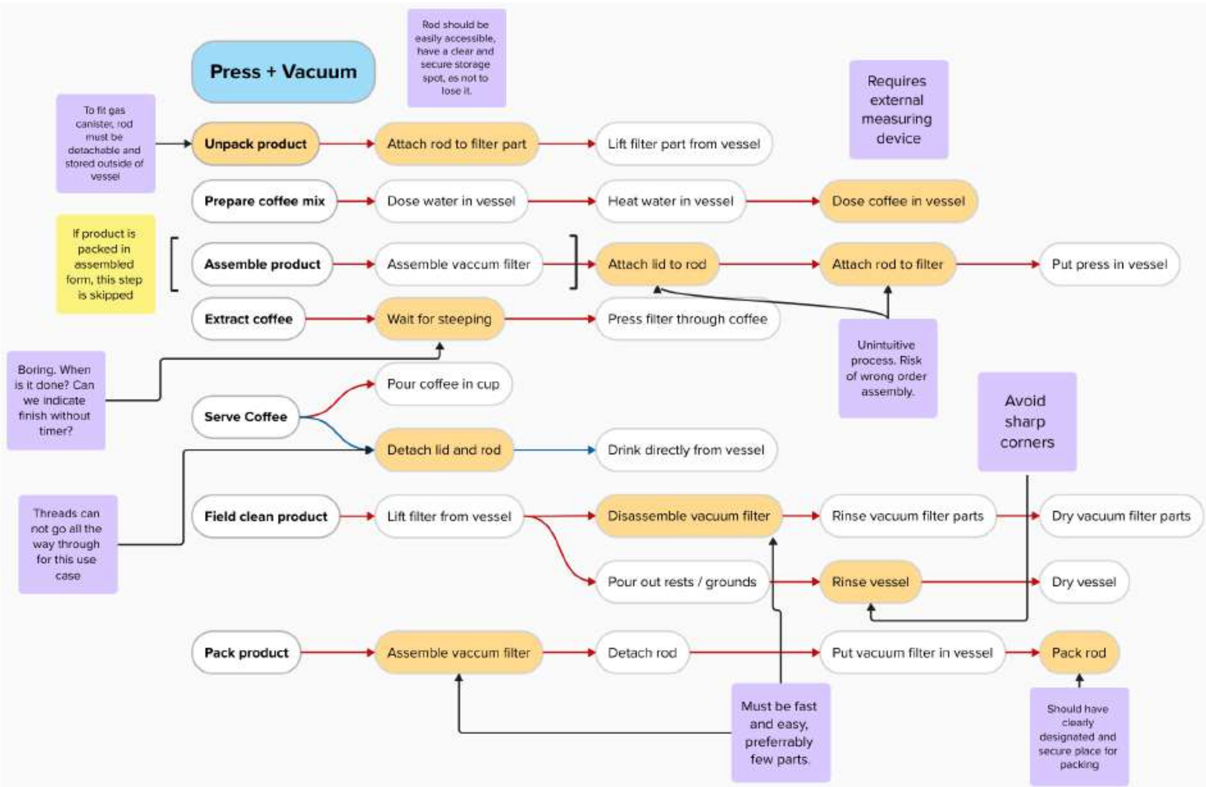

Figure A.9: Process flow with comments for the Vacuum Press concept

A.6 Morphological Matrices

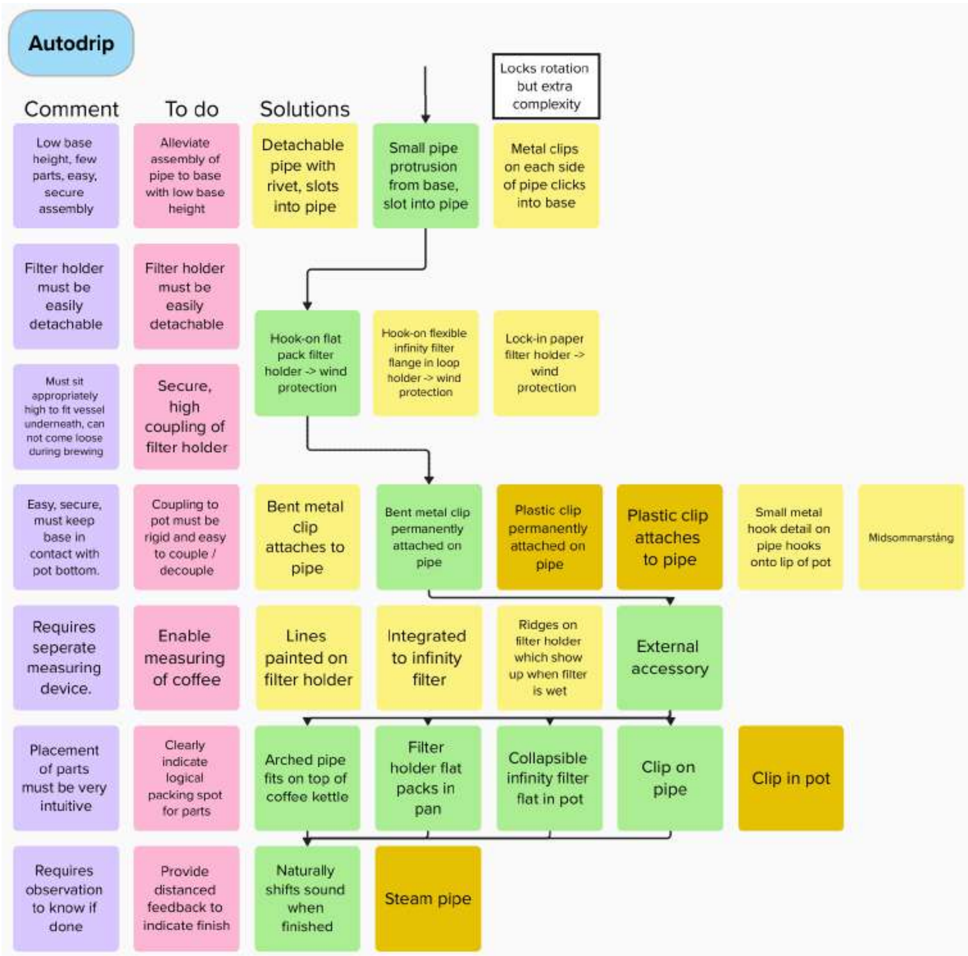

Figure A.10: The morphological matrix for the Auto Drip concept

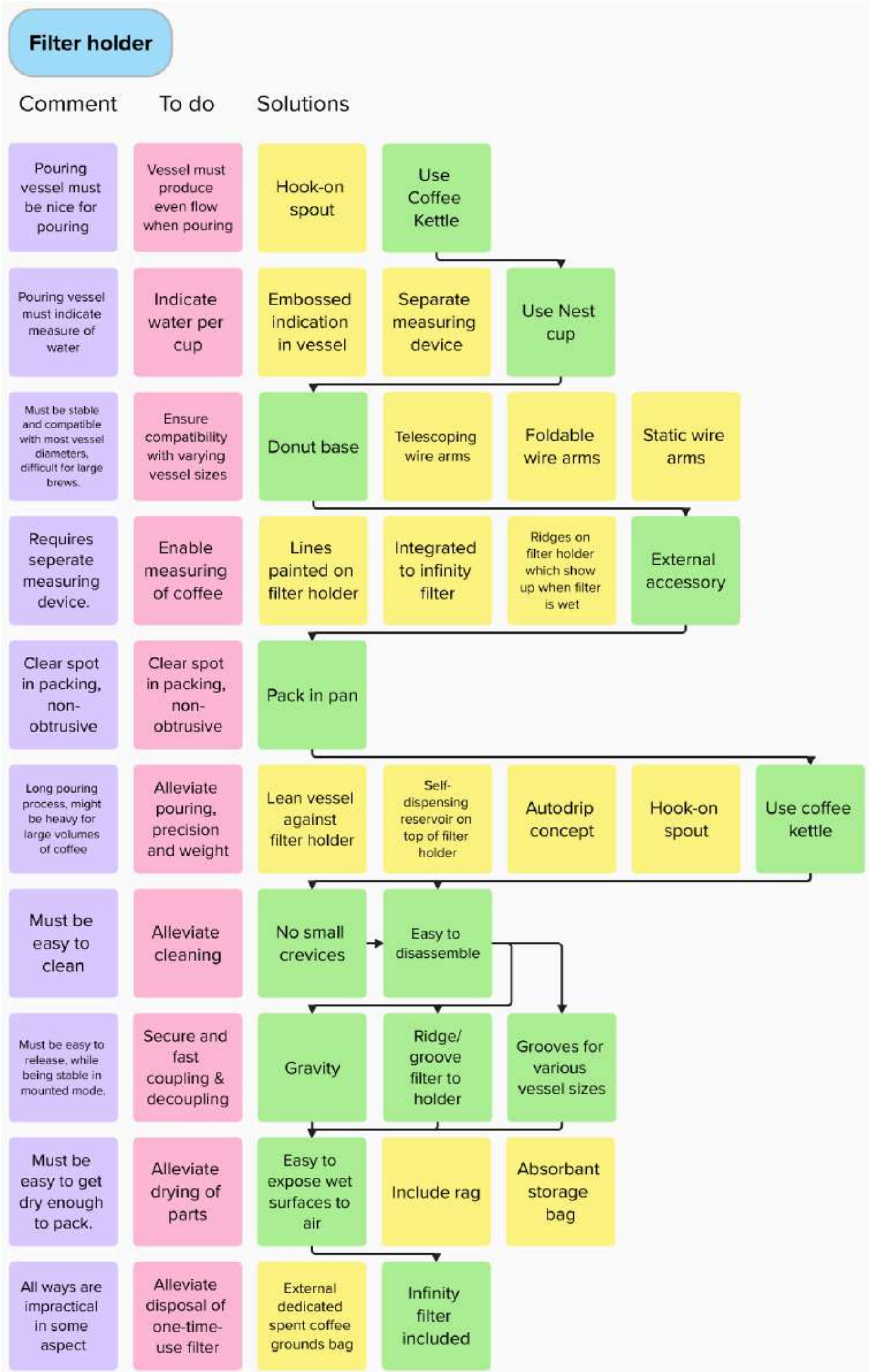

Figure A.11: The morphological matrix for the Filter Holder concept

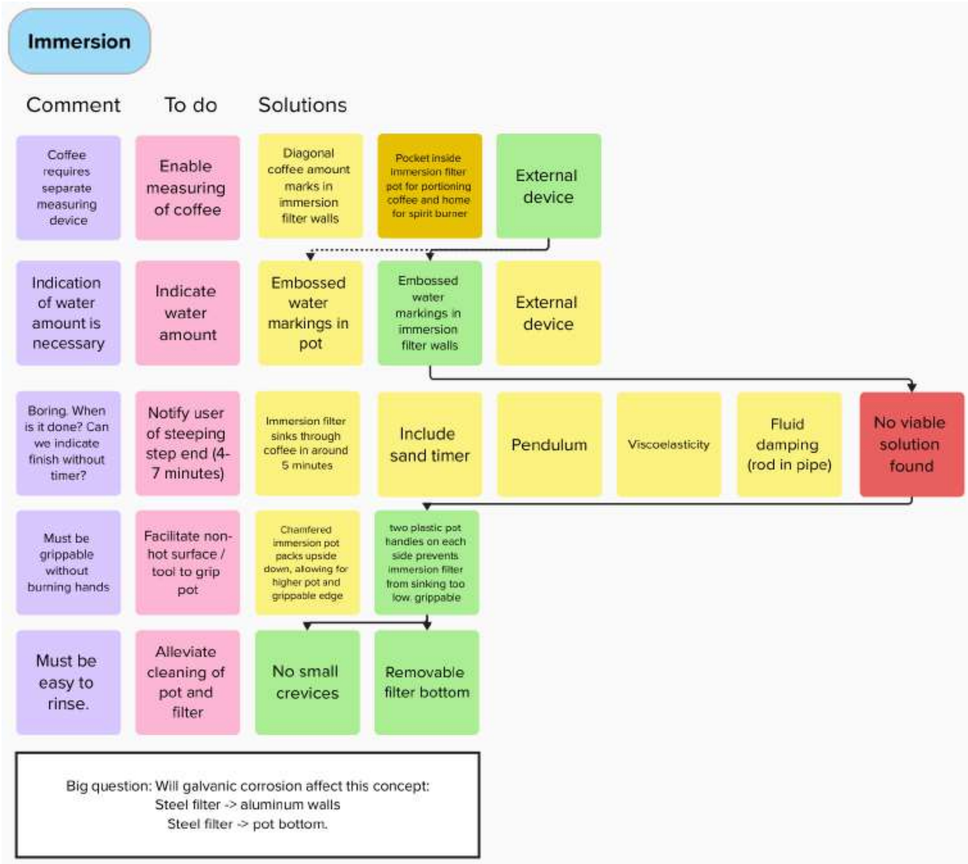

Figure A.12: The morphological matrix for the Immersion concept

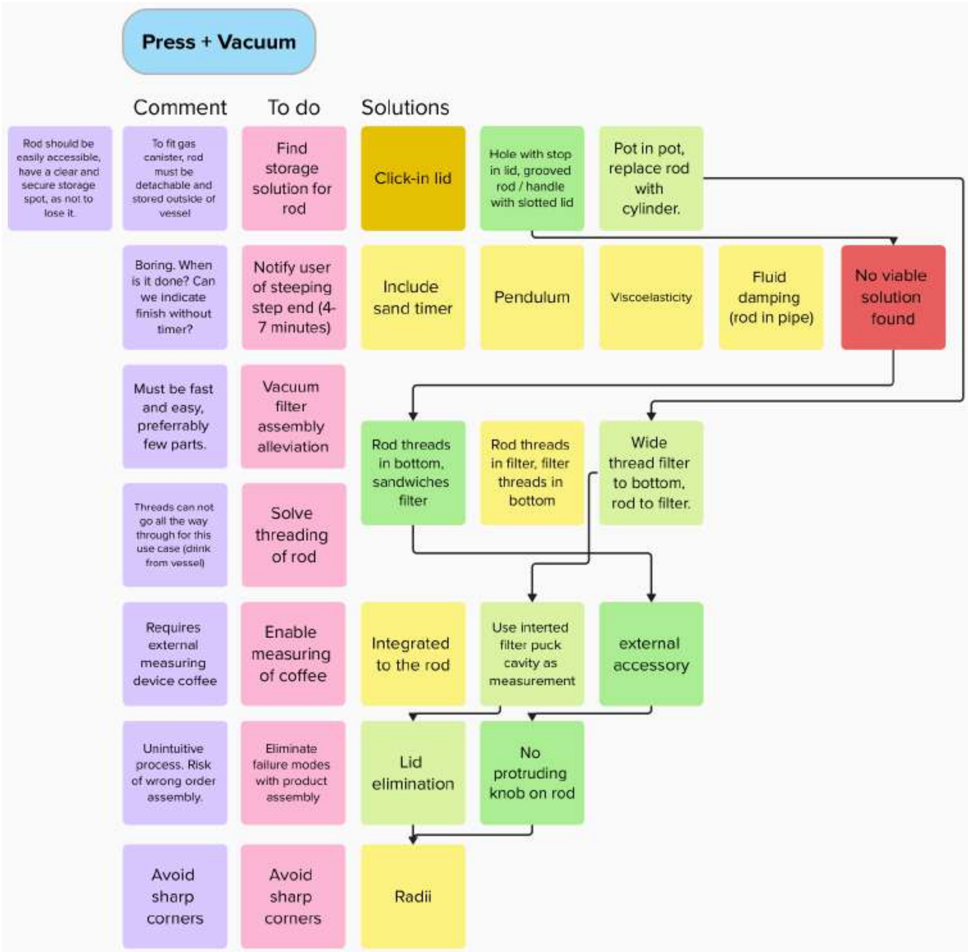

Figure A.13: The morphological matrix for the Vacuum Press

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