SUSTAINABLE LIVING ENHANCED BY ARTIFICIAL INTELIGENCE

Promoting Eco-Friendly Lifestyles and Envisioning Future Generations.

Francisca Melo Palma Salgado Silvano - Master's thesis - Process report

SERVICE SYSTEMS DESIGN

Aalborg University Copenhagen

MASTER'S THESIS

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Nicola Morelli

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AUTHOR
Francisca Melo Palma Salgado Silvano
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Aalborg University Copenhagen A.C. Meyers Vænge
2450 København SV, Denmark

Abstract

This thesis is the culmination of a master's degree in Service Systems Design, focusing on promoting sustainability in grocery shopping by **exploring Artificial Intelligence (AI)-driven solutions.** Conducted over six months, the project involved extensive research, ideation, and iterative prototyping to develop a system designed to promote sustainability within the retail sector. The study explores how supermarkets, particularly Føtex, a Danish chain, can empower consumers to make informed, and more sustainable choices.
Through the redesign of the Føtex app, the thesis proposes features that allow users to see sustainability data about products, encourage responsible purchasing, and balance environmental and social considerations in an accessible, user-friendly way. Transforming the grocery shopping experience through gamification, incorporating personalised challenges, reward systems, and educational tools that empower consumers to make informed and sustainable choices. The research emphasises the importance of user engagement in **fostering a community centred approach to sustainability**. By combining service systems design methodologies and incorporating continuous iteration, the solution aims to foster a mindset of conscious consumerism. This project contributes to the expanding knowledge on sustainability and demonstrates the potential of AI-driven services to **encourage eco-friendly consumer behaviour**, supporting a shift towards a more sustainable future.

Key words: Sustainability, Service Systems Design, Artificial Intelligence, Consumer Behaviour, Supermarkets, Environmental Impact.

Context

This thesis centers on the application of **Service Systems Design (SSD) methodologies and tools** to address the urgent need for a more sustainable future, using the skills and knowledge gained throughout my two-year master's program. It also addresses the growing need for sustainable consumer behaviour in the retail environment, particularly in grocery shopping. As concerns over environmental impact and ethical consumption increase, supermarkets are under pressure to empower consumers to make more sustainable choices (UNCTD, 2022).*

*United Nations Conference on Trade and Development

Abbreviations

AI: Artificial Intelligence
SCT: Supply Chain Transparency
NGO'S: Non Governmental Organisations
SSD: Service Systems Design
GMO's: Generic Modified Organisms
HMW: "How Might We"
SDGs: Sustainable Development Goals

Table of Contents

CHAPTER 1

Setting Up The Project

1.1 Learning Goals

In the course of developing this thesis, a series of learning goals have been set to guide personal growth throughout the project. These goals have been focus on expanding knowledge of service systems design, within the context of sustainability while project and time management skills were strengthened.

One of the main goals is to broaden my understanding of service design methodologies by improving my ability to apply these tools in practical, real-world challenges. This involves selecting the most appropriate methodologies for each specific situation, ensuring that the chosen approach is tailored to the context and problem being addressed.

This allows refining my skills in problem identification, ideation, and prototyping within the context of sustainable solutions.

Since the thesis explores how AI can support sustainable decision-making, another goal is to strengthen my understanding of AI technologies and their application in service systems, including learning how to leverage AI to influence consumer behaviour and promote sustainability.

The final goal is to better understand how sustainability goals can be incorporated into service design.

1.2 Project Planning

Throughout the project, **Figjam** and **Figma** were essential tools in the design process (Figure 1). These platforms kept all the research, including links to academic papers and desk research organised. They also facilitated the design and iteration of different SSD methods, enabling the clear visualisation of user journeys, stakeholder maps, and service blueprints e.g. An additional benefit of using Figma was its collaborative capabilities, which allowed my supervisor to view the designs in real-time while I iterate them. This functionality was highly useful during the supervision meetings, ensuring that feedback could be provided instantly, and my ideas and thoughts could be communicated clearly.

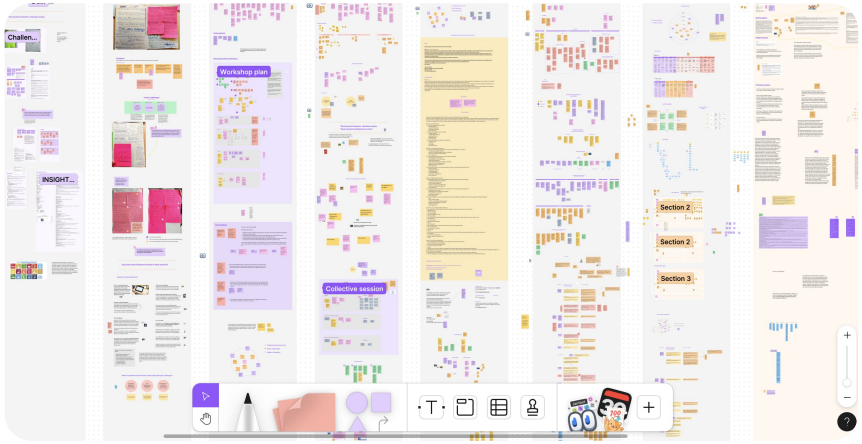


Figure. 1 - Figjam workspace setup used during the project for organising data

Tentative Plan

A visual planning calendar was used to assist in managing the different phases and tasks throughout the project, ensuring that all was organised and completed efficiently. This approach also helped keeping track of timelines, and supervision meetings. Activities, such as workshop facilitation dates and the project deadline, were mapped out to maintain a structured workflow and ensure the project progressed on time.
The calendar (Figure 2) was modified based on some changing circumstances during the development of the project.

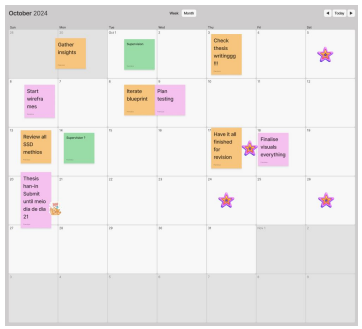


Figure. 2 - Visual planning calendar for managing thesis progress

CHAPTER 2

Project Methodology

2.1 Methodology Approach

Design Thinking Framework

The project adopted the Stanford model of design thinking for creative problem solving (Figure 3), with modifications to reflect the iterative flow of the process. According to Shanks (2020), iteration is fundamental to effective design, and this framework was chosen specifically for its flexibility, allowing for movement between the five modes defined by the Hasso Plattner Institute of Design (Stanford, 2017). Rather than being followed as a rigid step-by-step process, the methodology encourages flexibility and iterative development (Design Foundation, 2024). Throughout the project, multiple iterations were conducted, enabling further research when necessary, and continuous improvement of the solution. Both the solution and its execution were refined through feedback and reflective practices (Dam and Siang, 2019).

The process begins with understanding user's needs through empathy, ensuring the design addresses real pain points. Kolawole (n.d.) emphasises that empathy, the ability to step into another's "shoes", forms the foundation of innovative problem-solving. Next, the Define phase clarifies the problem, leading to Ideation, where different solutions are generated.

Dam and Siang (2024) describe ideation as a crucial phase in the design thinking process, where creativity is fostered to generate innovative solutions. Preparing for ideation sessions involves setting the right environment and framing the problem effectively to encourage productive brainstorming.

These ideas are brought to life during Prototyping, followed by Testing, where feedback from real users is used to refine the solution iteratively (Stanford, 2017).

The principles of human-centred design underscore the importance of starting from a place of uncertainty, where the solution is not initially known. As stated by Brown (n.d.), it is through listening, thinking, building, and refining that solutions are crafted to serve people effectively.

Immersing oneself in another's world fosters creative possibilities and breaks free from outdated ways of thinking.

This approach proved particularly effective for addressing human needs by examining the problem from different perspectives and encouraging iterative refinement (Dam and Siang, 2019).

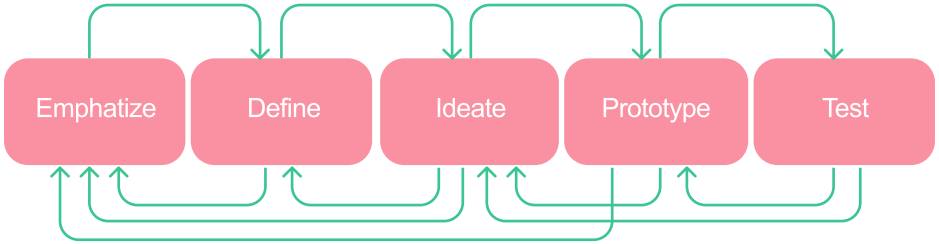


Figure. 3 - Model of Standfort d.school Design Thinking framework

2.2 Methods and Tools

During the project, a variety of methods and tools were used to gather insights, structure ideas, and develop the final solution (Figure 4). These methods ensured a comprehensive approach to Service Systems Design and helped address the complexity of the problem.

Desk and Literature Research: To provide foundational knowledge and insights into relevant frameworks.
Field Research: For data collection through on-site observations and visits to physical locations.
Online Surveys: To gather quantitive and qualitative data to inform design decisions.
Observation User Behaviour : Offered real-world findings.
Open Discussions: Informal inquiries to gather data.
Brainstormings: To generate ideas.
Workshops: Gathered insights and refined ideas.
Pattern Recognition: To analyse data collected and identify key patterns among the information.
Dot Voting: Facilitated prioritisation of ideas and exclusion of others.
Stakeholder Map: Identified key actors and their relationships in the system.
User Journey and Personas: To understand the pain points and needs of users and mapped user steps in the service to guide the design.
Service Blueprint: To Illustrate the full scope of the service, including visible interactions and its preconditions.

Architecture Systems Map: For visualisation the service and its exchanged flows.
Quatro Stagioni: Organised and categorised ideas.
Storyboard: For illustration of user interactions in a narrative way to communicate the design concept.

Figure 4. Tools and methods used in the Design Process

Emphatise Phase	Desk and Literature Research Online Surveys Observation User Behaviour	Open Discussions Pattern Recognition
Define Phase	Desk and Literature Research Workshops Pattern Recognition	Field Exploration
Ideate Phase	Desk and Literature Research Workshops Stakeholders Map	Dote Voting Pattern Recognition
Prototype Phase	User Journey Personas Service Blueprint Systems Architecture	Quatro Stagioni Storyboard Stakeholders Map
Testing Phase	Workshop Pattern Recognition	

CHAPTER 3

Defining the Project's Direction

3.1 Design Criteria

At the starting point of the project, key areas of interest were explored to determine which elements would be included in the design and project process.
In recent years, the importance of sustainability has grown significantly as societies face increasing environmental challenges.
Sustainable living has evolved from being a trend to becoming a necessity for ensuring the health and well-being of both the planet and future generations. To address these challenges, emerging technologies, particularly Artificial Intelligence (AI), offer innovative ways to promote eco-friendly lifestyles and enhance sustainable practices (Dannouni et al., 2023).
The focus was placed on **three main criteria:** future generations, AI, and sustainability. These criteria are closely interrelated, and their combination provides a holistic approach to addressing environmental issues in innovative ways.

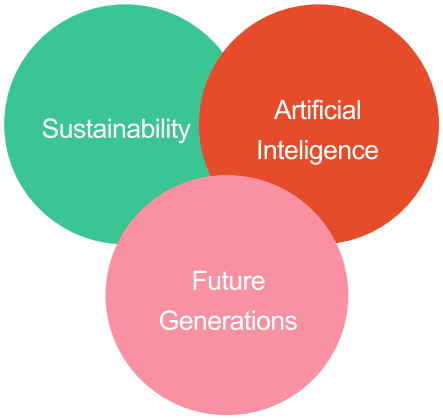


Figure 5. - The design criteria: AI, Sustainability and Future Generations

Sustainability

Sustainability was chosen as the main focus of this research due to its important role in addressing global environmental and resource challenges.
Environmental degradation, climate change, and the overuse of natural resources have highlighted the need for innovative solutions (Rolnick et al., 2019).
To develop a concept that is both impactful and long-lasting, some of the United Nations Sustainable Development Goals (SDGs) were considered (Chapter 6.4).

These goals serve as a framework that encourages individuals, companies, and government to work towards shared objectives, helping to collectively address the world's most urgent challenges (United Nations, 2015).

Figure. 6 -United Nations Sustainable Development Goals Available at: https://sdgs.un.org/goals)

Artificial Intelligence

According to the Massachusetts Institute of Technology, AI is defined as the ability of machines or computer systems to perform tasks that would normally require human intelligence, such as learning, and problem-solving (MIT, n.d.). AI systems are driven by algorithms and machine learning techniques, allowing cognitive processes to be simulated and tasks to be performed autonomously (Dannouni et al., 2023). It has also been observed that AI systems can also adapt to their environments, much like humans (Morandín-Ahuerma, 2022).
As advancements in AI continue, significant transformations are being seen across different industries, particularly through improved efficiency and accuracy in handling complex tasks (Morandín-Ahuerma, 2022). Due to its transformative capabilities, AI has been identified as a critical design criteria, especially in sectors focused on sustainability.
The ability of AI to process large data, identify patterns, and help finding solutions that may not be easily recognisable to humans is key to addressing complex challenges. Its contribution to optimising resource use and predicting environmental impacts, such as climate-related risks, has been considered an essential (Dannouni et al., 2023).
AI's has been shown to play a significant role in reducing the environmental footprint of manufacturing and transportation sectors, further highlighting its importance in sustainability efforts
Its role in enhancing sustainability is underscored by its capacity to minimise energy consumption and improve waste management, thereby supporting resource conservation

efforts (Jebbor et al., 2024). For example, AI systems have been applied to optimise energy grids and renewable energy systems, leading to improvements in energy efficiency (Babber et al., 2021).

Future Generations

The inclusion of future generations as a design criteria reflects the long-term implications of our current lifestyle choices. It is essential to consider how today's decisions, particularly regarding resource consumption and environmental responsibility, will impact the lives of future generations. By integrating this perspective, sustainability becomes not only about immediate changes but about building a framework that ensures the well-being of generations to come (Dannouni et al., 2023). This focus aligns with environmental concerns about resource reduction and environmental degradation (Rolnick et al., 2019), emphasising that the current generation holds responsibility for the planet's future health.

3.2 The Project Focus

AI's Role in Transforming the Food Industry

Sustainability is a broad topic that includes many areas, but from the beginning, the focus of this project was placed on the food industry. During an internship as a UX/UI designer at a startup called Seasony, which operates within the agricultural sector, interest in AI was sparked by the company's work with a robot named Watney. The robot is used to assist in vertical farming by detecting diseases in crops, leading to time savings and reduced production costs.
Building on this experience, the initial focused was on the application of AI in the food industry. Various aspects about this topic were researched during the project, such as how AI is applied in food production and its contributions to sustainable practices, such as challenges and obstacles of its integrating into sustainable food systems were explored. Furthermore, consumer behaviour in relation to AI and its role in promoting sustainable behaviour in relation to AI and its role in promoting sustainable consumption were analysed to understand how AI can support more eco-friendly decision-making within the food industry.
The goal was to understand how AI can influence eco-conscious decisions and how can it help guiding consumers toward more sustainable food choices.

Narrowing Scope

In the initial stage of this thesis, the research question considered was, **"How can AI be integrated into the food industry for a more sustainable society?"**
It is acknowledge that this question have been too broad, however, at the initial stage, the intention was to explore a wide range of possibilities.
A brainstorming (Figure 7) was conducted, resulting in the identification of several topics representing some environmental challenges within the food industry, including food waste, eco-footprint (e.g. high water usage), the impact of climate change, and health problems provided by genetically modified organisms (GMO's), pesticides, and processed food.
Upon further consideration, the focus was narrowed to the environmental aspects within the food industry.
Séralini et al. (2020) conducted a study that highlights that the use of GMO's, pesticides, and food processing raises concerns about their long-term effects on both the environment and human health.
This group of GMO's, pesticides, and processed food were then combined under the theme of **"environment and human health,"** focus allowing for a more specific area of research to be pursued.

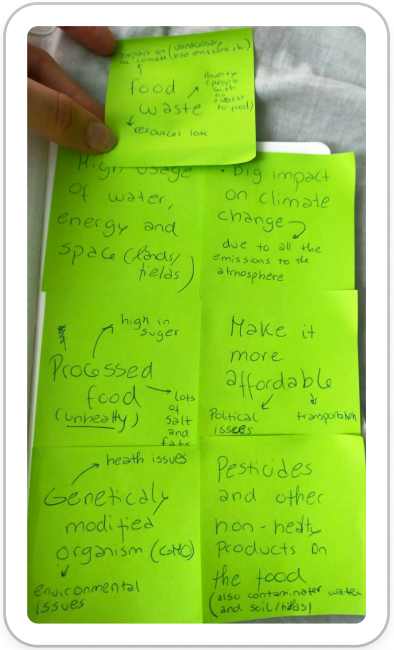


Figure. 7 - Environmental challenges within the food industry

CHAPTER 4

Uncovering user's Mindsets

4.1 Online Survey

An online survey (Appendix 1) was conducted at the start of the empathise phase to gather initial insights into individual's views on sustainability when purchasing groceries. The primary goal was to understand shopping habits and priorities, particularly regarding sustainability, and how these factors influence decision-making. The survey also pretended to evaluate consumer awareness and concerns related to food sustainability and health (Figure 7).
The target group included future generations, focusing on teenagers, young adults responsible for their own grocery shopping, and environmentally conscious individuals who prioritise sustainability in their choices. The survey, titled "The Decision-Making Process When Buying Groceries," began with a brief introduction explaining the research's purpose. Responses were collected from 50 participants providing valuable insights for the research.
The survey was iterated before being send to avoid generic questions, for gathering more specific insights.
Overall, the findings highlighted participant's awareness of sustainability and health issues in food choices, along with their openness to integrating AI tools into grocery shopping to assist in making more sustainable decisions (Figure 8).

Findings from the Survey

The conducted survey helped gathering valuable insights regarding concerns related to sustainable grocery shopping that helped confirm the initial assumption that, while people express concern for the environment, they are generally not well-informed about sustainable food choices.
It was verified that while there is considerable interest in making healthy and sustainable choices, many respondents reported not being to informed on critical issues such as pesticide use and the presence of genetically modified foods. Price was also identified as a big factor that often limited the ability to make sustainable choices. Additionally, confusion emerges when the respondents try to find information on the product as the labels can be difficult to read and understand and a lack of clear and standardised information were recurring challenges. Despite these

barriers, there was notable interest in utilising AI tools to assist in making more informed decisions by providing easy access to information on health, and sustainability. These findings emphasise the need for better education and clearer product information to facilitate more sustainable consumer behaviour.

Reflections on the Survey

The question number seven "Do you think it could be interesting to use an AI-powered tool that analyses product labels and highlights information relevant to your priorities (health, sustainability) while grocery shopping?" may have introduced some bias by limiting responses to simple yes/no/maybe answers. A more effective approach could have involved asking respondents what specific actions they believe AI could assist during shopping.
For example, the question could have been phrased as: "For which specific tasks do you believe AI could be most beneficial in assisting with grocery shopping?" This could have allowed participants to select from options such as finding vegetarian products or finding about the carbon footprint impact of a product e.g.
This approach would have provided more detailed insights into user's expectations and preferences regarding AI integration in grocery shopping.
After reflection an open question was sent to a group of individuals to explore this finding more in depth (Chapter 4.4).

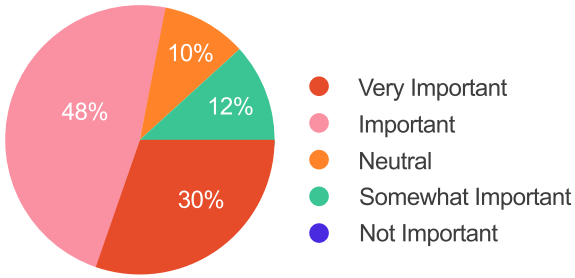


Figure 8 - Participant's replies on the importance of sustainable and healthy products.

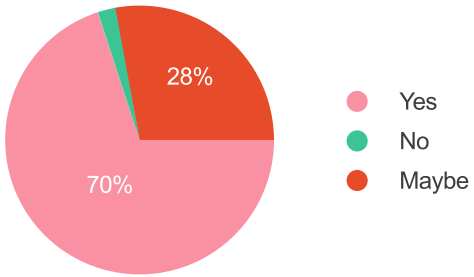


Figure 9 - Participant's replies on AI integration in grocery shopping.

4.2 Observing User Behaviour

Observing users interacting with environments can uncover unforeseen behaviours and assist in identifying issues at an early stage (Gomol, 2001) so this method was used to understand the decision-making process of different individuals related to sustainable food choices. Using the a supermarket as a setting the participants were one flatmate and two friends, Charlie (female, age 23), Jason (male, age 25), and Patrick (male, age 30). The chosen location was the Føtex near Carlsberg station, selected for its proximity to the participants and its wide variety of food options, offering multiple brands for each product.
During the observation, notes were taken using a phone to document the participant's behaviours.
The "think-aloud" method was employed, where participants verbalised their thoughts (Gomol, 2001) while making grocery decisions, particularly regarding sustainable choices. The aim was to create a comfortable environment where participants could express their thoughts freely, a goal easily achieved due to the existing friendships. Participants were asked to simulate shopping for the upcoming week or next few days, selecting products they typically buy and explaining their reasons for choosing them.
The observation followed participants through their natural shopping flow, focusing on product selection and decision-making processes. Product selection involved noting the types of items participants considered, and understanding their motives for choosing those specific products. The decision-making process was further explored by observing the factors participants considered when comparing products, such as price, label information, environmental impact, and health benefits.
Attention was also given to the challenges participants faced, such as confusion over product labels, or whether price was mentioned as a barrier to more sustainable options.
After the shopping activity, a brief post-shopping discussion took place outside the store to thank participants and briefly reflect on their overall experiences.
For data analysis, the notes were reviewed and a common theme in their decision-making processes was identified, including challenges faced and factors influencing their decisions.

User Observation Behaviour Findings

Charlie (Figure 10) is a student who works part-time, follows a vegetarian diet, and prioritises healthy food options within a limited budget. Her grocery shopping habits reveal that she consistently chooses vegetarian products and makes an effort to eat healthy. She typically shops once a week for planned meals, with occasional visits to purchase specific ingredients. Despite her familiarity with the store layout, she sometimes experiences confusion when searching for organic or biological products, especially when choosing vegetables she is unsure if they are locally sourced and genuinely organic. While she appreciates the variety of vegetables and finds the prices reasonable, she struggles with limited options for certain items, such as couscous or quinoa, which she also finds expensive.

Jason (Figure 11) works part-time, he doesn't have any diet restriction, and prioritises budget-friendly options. His shopping habits shows frequent trips to the supermarket due to a lack of advanced meal planning. With a tight budget, he focuses primarily on price rather than product quality or sustainability, showing little concern for whether products are local or organic. He is unclear about the placement of more eco-friendly products in relation to other items in the store.

Patrick (Figure 12) works full-time, follows a vegetarian diet, and has a strong interest in sustainable food choices. His shopping behavior reveals a particular focus on the fruit and vegetable section, where he spends more time. He expresses frustration with the use of plastic packaging on certain items, such as cucumbers, and does not understand why some vegetables are wrapped in plastic while others are not. Patrick also struggles with interpreting product labels, especially when trying to find how sustainability are the products. He avoids using plastic bags by placing vegetables directly into the cart but remains unsure of how to identify products that are truly sustainable.

Patterns in the findings

The user observation revealed a consistent lack of information across all participants when it came to making sustainable grocery shopping decisions. It was observed that participants struggled with understanding product labels, particularly in identifying whether products were organic and sustainably produced.

Reflection on the User Observation Behaviour

The decision to initially pursue this method was made with the intention of using it as a tool to better understand, in a real-life setting, the decision-making processes of users and to observe the challenges they might face when shopping more sustainably. However, the approach proved less helpful for the data analysis due to the limited number of participants.

Figure 10 - Charlie

Figure 11 - Jason

Figure 12 - Patrick

4.3 Analysing Data

From Findings to Insights

The findings from both the user observations and survey results were reviewed to extract key insights. These insights offered a deeper interpretation of the data by uncovering the reasons, behaviours, and patterns that explain the observed outcomes, moving beyond raw observations to provide a more comprehensive understanding of consumer motivations (Fiaidhi and Mohammed, 2019).
The responses revealed that most individuals consider purchasing healthy and sustainable food very important but the lack of knowledge about the way products are produced and limited access to detailed product information, particularly regarding environmental or ethical aspects, is a big challenge when trying to buy more healthy and eco-friendly.
Additionally, many participants believed that AI-powered tools could help in making more informed food choices by providing these information.
Several insights become visible from the analysis, highlighting consumer concerns. Many respondents placed a high value on purchasing healthy and sustainable food, reflecting growing awareness of the environmental and health impacts of their choices. However, factors like price, complexity in labelling, and greenwashing were seen as significant barriers.
Although respondents were aware of the origin of the some food they purchased, there was limited access to more detailed information, pointing to a need for greater transparency and comprehensive product labels.

Challenges Identified

Affordability was a big concern, with many respondents indicating that sustainable products are often perceived as too expensive and less accessible. This price barrier limits the ability of consumers to make sustainable choices, despite their willingness to do so.
Complexity in food labels was another issue, as users struggled to determine whether a product was genuinely sustainable or ethical.
Concerns over greenwashing, and plastic packaging was noted as a frustration for some users.
Availability of organic, local, or ethically sourced products was also limited, making it difficult for consumers to find these options easily. Labelings inconsistencies across brands added to this frustration, making it harder for consumers to compare products and make informed decisions.
The research and analyses identified three main challenges (Figure 13) that influence consumer's ability to make sustainable food choices:

Affordability of Sustainable Products

Affordability remains a critical issue, as the higher costs of sustainable products often prevent consumers from choosing them, even when they prefer eco-friendly options. Studies suggest that addressing cost barriers through subsidies, incentives, or industry reforms could make sustainable food more accessible (Penm et al., 2021; Hendrie et al., 2020; Strübel et al., 2023).
Furthermore, educating consumers on the long-term benefits of sustainable products could shift purchasing behaviour toward these options (Camilleri et al., 2023).

Lack of Knowledge

Consumers are often not well-informed about the environmental impacts of their food choices. Research suggests that when individuals are provided with clear information about the positive environmental outcomes of their purchases, they are more likely to choose sustainable products (Alghamdi and Agag, 2024). This underscores the importance of providing transparent and easily accessible information to guide more eco-conscious purchasing decisions

Complexity of Food Labels

The complexity of food labels presents a significant barrier to making informed decisions. Clearer labels, as noted by the European Commission (2022), could reduce confusion and help consumers make healthier, and more sustainable choices. Research also shows that when labels are designed to be simple and easily readable, consumers feel more confident in their purchasing decisions (Licholai, 2023). Simplifying labels and incorporating environmental impact scores on the products may also enhance decision-making.
By addressing some of these challenges more consumers could be empowered to make informed, sustainable food choices.

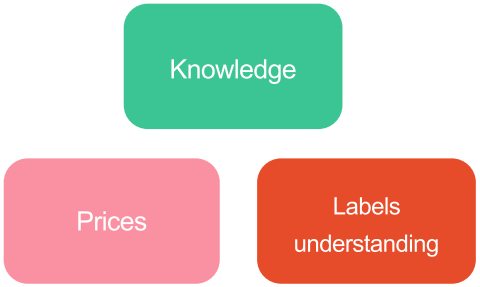


Figure. 13 -Key Challenges

Reflection on the data collection analyses

The focus of the project was guided by the analysis of the survey, user behaviour observations, and supported by literature research, with the goal of addressing some of these challenges. The affordability issue was later excluded, and the focus was placed on the other two challenges related to information (knowledge and label understanding).

Research shows that consumers are increasingly willing to pay more for products that clearly present more information about their supply chain values (Brun, Karaosman and Barresi, 2020).
Even so this fator was excluded after reflection on the complexity of addressing this issue. While recognised as a big challenge for many participants, it was concluded that addressing this issue, in addition to the other challenges, would have been excessively ambitious. Furthermore, the issue of pricing is influenced by the financial circumstances of each user and the value they place on sustainable purchasing or a specific product. For instance, one user may find the price of a product acceptable because it reflects the value they associate with it, while another may consider the same product as expensive, as they place less value on the product.

The decision to focus on increasing user's knowledge was based on the belief that empowering users with information is a more significant and impactful goal.
In this context, the choice to prioritise knowledge and label comprehension over affordability reflects a strategic decision to focus on areas where immediate progress can be made. While affordability remains a significant issue, the approach of empowering users with better understanding and clearer information is seen as a crucial step toward fostering a more sustainable future.

4.4 Open Discussion

Integrating AI in the Food Decision-Making Process

An open question was asked to some individuals, both in presence and by text message including friends, family, and colleagues, to better understand their views on where AI could be most helpful in making grocery shopping more sustainable. The question was made personally to some and send through text messages to others in order to gather more responses. The question was directed to individuals who had a general understanding of AI to gather more informed responses.
The question asked was:

> "At **what stage of your grocery decision-making process** do you think **AI could make the most significant impact** in helping you make more sustainable choices? Would it be before you go to the supermarket, during your shopping, or after your groceries shopping? Please specify how you believe AI could assist you at that point."

All responses were noted and reviewed, then clustered as several were either the same or similar (Figure 14).

Pre-Shopping: Planning and Preparation

Some respondents indicated that AI could play a crucial role before grocery shopping, particularly in the planning phase. This would involve AI tools assisting users in planning groceries where AI could help creating shopping lists, ensuring consumers could find seasonal and locally-sourced products, finding sustainable products from different supermarkets or suggest alternatives to products with lower footprints. These responses were about providing sustainability information about different food choices, as explaining their environmental consequences.

During Shopping: Information and Assistance

Most responses suggested that AI could make a difference during the shopping process. In this scenario, AI would serve as guide to help consumers identifying healthier and more sustainable products.

E.g. mobile apps could scan products in real-time, informing users about the the sustainability of each item, and suggest healthier or more sustainable alternatives.
AI tools could simplify this information by providing easy-to-read summaries of a product's nutritional value, and info about other relevant information.

Post-Shopping

Only one respondent saw AI as being most useful after shopping.The suggestions were AI helping managing food waste offering tips on how to store food or provide reminders on when to consume different items to prevent them from going to waste.

Although respondents supported all stages, as it can be seen in (Figure 15) the informal inquiry responses (Appendix 2.) revealed that respondents believe AI has significant potential to enhance sustainable food choices, mainly in the pre-shopping and during shopping phases.

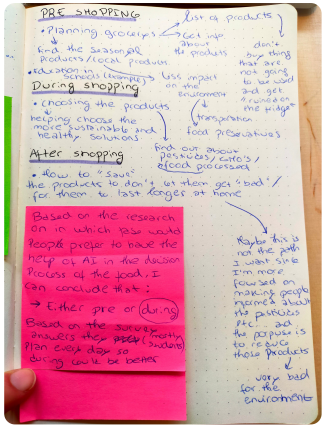


Figure. 14 - Clustering answers

"I think that AI could use my grocery shopping list and/or my previously bought items to suggest replacements that are more sustainable keeping the product characteristics as similar as possible".
- Alexandre

" personally it would **be during to visit to the supermarket.** This is usually the point where I have more time to research the products I want (...) AI could assist me simply by making access to the info more simple and convenient"
-- Emilie

" for my lifestyle, it would be most useful **after shopping**. It could help me keep track of the products I've bought, what I have in storage, and remind me when something is about to expire."
- Luísa

Figure. 15 -Excerpts from Open-End question: Pre, During, Post shopping

4.5 Defining the Target Group

Although the project focuses on future generations, the target group was considered to include eco-friendly individuals who are concerned about sustainability and environmental impact and committed to creating a better future. The vision behind this consists in the project's purpose to develop a solution that can be implemented in the present while delivering long-term benefits. This approach reflects on a broader ethical responsibility towards future generations requires us to consider the lasting and irreversible impacts of our current actions (Gaba, 1999). The idea of "Future Design" advocates for creating systems that promote decisions that prioritise long-term benefits for future generations (Saijo, 2020). This aligns with the goal of this project that is to develop a solution that can be adopted nowadays, starting with small user actions and gradually shape and influence the future, creating benefits for both the present and the future of individuals and the planet.

CHAPTER 5

Exploring Possibilities

5.1 “How Might We” brainstorm session

The "How Might We" (HMW) technique, introduced by Tim Brown in Change by Design (2008), was used to reframe challenges and opportunities, fostering an explorative mindset. This approach encouraged creative thinking by broadening the scope of the problem. Through this process, the focus was narrowed down to a specific, chosen problem, enabling more targeted and effective solutions to emerge (Brown, 2008).
A brainstorming was conducted to explore numerous ideas, allowing for the generation of diverse thoughts (Figure 16). This process helped to refine and narrow down the focus of the project.
Colour-coding was employed to visually group similar HMW statements.
Blue was used to represent challenges related to price, green highlighted issues around understanding labels and assessing health or environmental impacts, and lilac represented the overall user experience or flow within the supermarket.

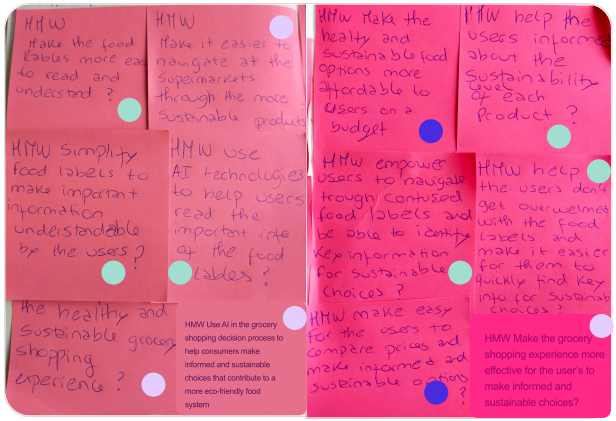


Figure. 16 - HMW brainstorm questions with colour coding

This technique helped in identifying common themes, making it easier to cluster related ideas. After clustering, I further combined similar HMWs to create more cohesive and refined categories, streamlining the process for more focused brainstorming. After various possibilities were considered, a new HMW question was formulated (Figure 17) that effectively captures the core issue and aligns with the project's goals.

> How might we integrate AI into the grocery shopping process to empower consumers to make informed, eco-friendly choices, that contribute to a more sustainable food system?

Figure. 17 - New HMW Question

It became evident that empowering consumers at the point of purchase plays a crucial role in driving sustainable choices. By focusing on the integration of AI into the grocery shopping experience, opportunities can be explored to develop tools that benefit consumers directly and encourage choices aligned with sustainable practices. This integration is expected to contribute to a more sustainable food industry and society overall.

5.2 Desk Research

To explore how AI is currently being used to assist consumers in grocery shopping, desk research was conducted to identify existing tools and technologies. The research focused on discovering AI-driven solutions that enhance the shopping experience, promote sustainability, and help user's finding what they need. Different implementations in the retail and food sectors were identified, highlighting the growing role of AI in supporting informed and eco-friendly consumer choices.

Smart Shopping Carts: Advanced carts where users scan items, weigh produce, and track total cost in real time, while integrating loyalty accounts for promotions and savings (Fox Business, 2023).
Veeve's AI-powered carts display promotions and use cameras to identify stock issues for faster management responses (Veeve, n.d.).

Real-Time Price Comparisons: AI is already tracking and comparing prices across brands and stores, helping consumers finding the best deals and stay within budget (LinkedIn, 2024).

Carrefour AI Assistance: Carrefour supermarket uses AI to assist with budgeting, dietary restrictions, menu planning, and ways to reduce waste by reusing ingredients (Carrefour, 2023).

AI for Label Analysis: Apps like Fooducate analyse product labels, and generate sustainability ratings from databases to help in purchasing decisions. (fooducate, n.d)

Kroger Operations: Kroger uses AI to track sales and restocking needs, ensuring product availability and building customer trust (IBM, 2021).

Basket App: This app helps users create shopping lists, compare prices across stores, and track cost-saving (Trybasket, n.d).

Open Food Facts: It's a NGO that gives information on food products worldwide, including ingredients, nutritional information, and sustainability data (Open Food Facts, n.d.).

Amazon Price Assistant: AI monitors that compare prices across retailers, helping users find the best options (Chrome Web Store, n.d.).

Thrive Market: An online platform offering organic, non-GMO, and sustainable products, supported by AI to help users find eco-friendly options (Thrive Market, n.d.).

CarbonCloud: AI estimates the carbon footprint of food products, giving users insights into the environmental impact of their choices (CarbonCloud, n.d.).

5.3 Ideating Potential Solutions

After the previous research and analysing open question it was decided that I was going to focus on ideating for a solution to help the users during the shopping and the main purpose was to gave them the information they need to be able to do more sustainable purchases. Another brainstorming session was made to generate ideas that could be useful further in the process to shaping a solution. These ideas (Figure 17.) were categorised into two stages with the mindset of ideating possibilities for the decision making process at the supermarket, from the moment of choosing the products until the moment of finalising the shopping.

The dot voting method was employed in this process to highlight ideas that seemed most promising for further development. Although typically used in group settings for collective decision-making, dot voting can be adapted for individual use, as suggested by Lucidspark (2024).
In this context, the method allowed a clear prioritisation of ideas even without collaboration (Tufts University, n.d.) and helped categorise them based on their potential of implementation. This worked to decide whether to use an idea (blue dot), think on the idea but with modifications (green dot), and ideas without any dots were automatically excluded from further consideration (Figure 18).

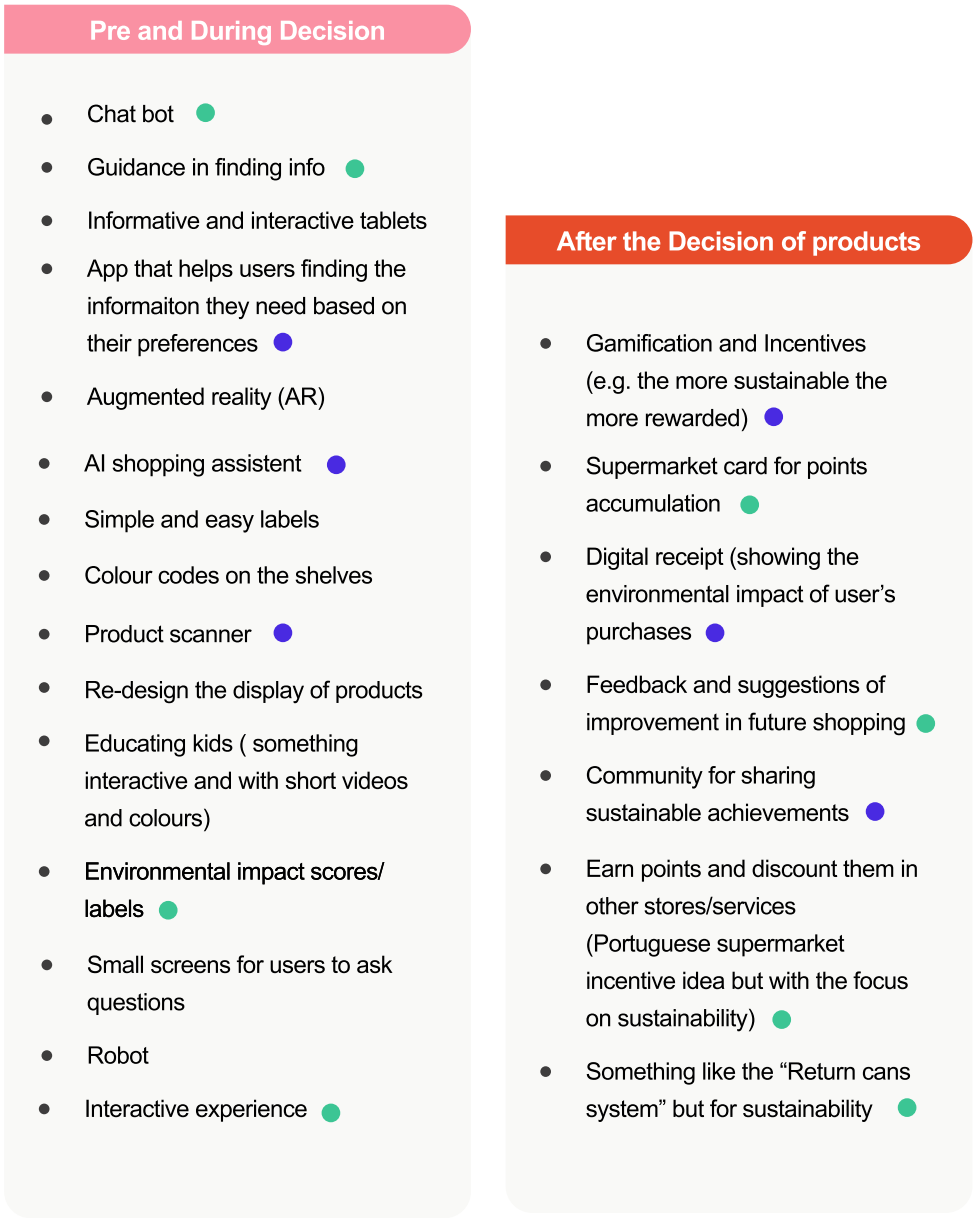


Figure 18 - Brainstorming Ideas with dot voting method

Pre and During Stage

This stage is the evaluation and selection part where the main goal is to provide the users with the necessary information to do more conscious and sustainable decisions.
Based on the brainstorming an possible idea was the implementation of gadgets such as scanners to would allow users to obtain product information before making a purchase. This could also be trough an app that would scan the products and shows their environmental impact, and other informations regarding the environment, with the potential to integrate AI for real-time updates and product recommendations based on user preferences.
This system could also give suggestions on eco-friendly alternatives, making the decision at the supermarket easier.
It was also consider adding a colour-coded systems on shelves to visually indicate the sustainability level of products.
The use of AI-powered interactive robots or smart screens to assist shoppers was also considered.
These systems could answer questions, guide customers to sustainable products, and provide personalised recommendations based on their preferences.

This aligns with the growing use of AI in the retail industry to enhance user experiences.

After Shopping Stage

At the post purchase stage it was considered to use a incentive and reward based ideation so the Danish return system (Dansk Retursystem, n.d.), it was considered and a similar approach could be interesting to explore. In Denmark, individuals earn money by returning empty drink cans to the supermarket for recycling, the more cans they return the more money they get, which can either be discounted at the store or received in cash. For the solution, a similar reward mechanism could be applied, but instead of recycling, users would be rewarded for making sustainable purchases. The more sustainable products they buy, the more rewarded they would be, encouraging eco-friendly consumer behaviour.
It was also considered displaying users environmental impact at the end of the shopping, for example at the self service cashier screens or as a digital receipt. This data could be stored on a card or an online platform, where users accumulate points or receive discounts for future purchases. This would create an engaging, long-term commitment to sustainable shopping.
For further encouraging sustainable consumption the possibility of creating a community space for sharing and incentive others to buy sustainably was also thought.

Although the original ideas were designed with a broader scope, not only focusing on AI technologies, AI has significant potential to be incorporated into the ideas where it was not presented yet.

Assumptions

Several assumptions emerged during the brainstorming session, such as the target group have a basic knowledge about AI, that gamification, and rewards are a good incentive to sustainable purchases. It was also assumed that users are more likely to adopt sustainable practices when they understand the reasoning behind them. Also that having the availability of clear information about the health and environmental consequences of their choices can be potential motivators. To test whether such approaches would indeed encourage more sustainable purchasing decisions and to validate some of these assumptions, a workshop (Chapter 5.4) was conducted.

5.4 Workshop

A workshop was planned aiming to explore how AI can help users making more sustainable choices when shopping at supermarkets. The goal was to test assumptions, and engage participants in activities that would reveal insights into how AI solutions could be integrated into the shopping experience.

Workshop Setup

The workshop was planned to take place at CPH Village Vesterbro in Copenhagen, using the common area of the student residence for its spacious area, tables, and a relaxing garden space where participants could socialise afterwards.
Beverages were also planned for after the workshop, providing an informal atmosphere for further discussion.
An invitation (Appendix 3) was sent to friends and colleagues via different social media platforms and shared in my personal social media with the intentions to attract more participants.

Workshop Activities

Due to the limited number of participants on the workshop day, adjustments were made to the activities. The icebreaker activity was shortened to a brief introduction of the workshop, project goals, and an overview of AI. Additionally, instead of forming multiple small teams, it was decided that all participants would work together as a single team for the remaining activities.

Activity 1: Icebreaker and Introduction to AI

After considering various icebreaker options an activity inspired in the memory game was planned. Participants would receive paper cards and they would have to find their matching pair by asking questions to each other. Once paired, a brief discussion about workshop would be made as an introduction to the objectives of the activities, and introduction to AI to allow participants to think more broadly about AI-powered tools and how they might assist with sustainability.
Additionally, this tested the assumption that participants had some prior knowledge of AI technology.

Activity 2: Exploring Different User Needs in Grocery Shopping

This activity focused on identifying the specific interests and needs of each participant when choosing sustainable products.
Participants were given an A4 paper template for individually “creating their dietary profile" (Figure 19) and coloured pens.
The exercise consisted in filling in details about their dietary restrictions, shopping priorities (e.g., healthy, budget-friendly, sustainable), and values they considered important when making food choices. This tested the assumption that users have diverse needs and priorities when shopping, as well as differing levels of awareness regarding sustainability factors.
This activity fostered reflection on individual shopping habits and laid the foundation for collaborative idea generation.

Reflection on the activity

After consideration it was noted that it could have been beneficial to include reflection questions that would prompt participants to think more deeply about their shopping habits and sustainability values (questions similar to the previous survey (Chapter 4.1) but more focus on the values when choosing a product.

Figure 19 - Create your Dietary Profile Template

Activity 3: “Create Your AI Superhero”

In this collective brainstorming session, participants were tasked to imagining AI-powered tools that would help them making sustainable choices at the supermarkets.

Step 1: Gather as Many Ideas

Participants would have worked in small groups to brainstorm potential AI tools for supermarkets within a 5-minute timeframe, following a similar approach to the "Crazy 8s" exercise (Design Sprint, n.d.). However, unlike the traditional method, no specific number of ideas was required. This adjustment was made to prevent participants from feeling pressured, allowing them to focus on generating as many ideas as they could.

Step 2: Bringing an idea to Life

Teams would have to select one idea from their brainstorming session and built upon it using the "Yes, and" technique (This is Service Design Doing, n.d.) that was explained previously to the participants by given an example. To avoid guiding participant’s ideas, the example was given using a different scenario. For instance, in the case of a smart home app, one participant might suggest that the app could turn on the lights, while another could build on this idea by suggesting that the app could also adjust the light intensity, and so on.
This exercise encouraged participants to expand on their ideas and develop a more comprehensive solution.

Step 3: Mission Debriefing and Idea Voting

After creating their AI superhero, each team had to present their idea, explaining its functionalities and how it could address challenges related to sustainable shopping.
This activity promote collaboration and creativity, with participants working together to develop AI-powered solutions.
The materials used were A4 paper for ideation, post Its, and colour pens.

Activity 4: Wrap-Up

The initial idea was that the participants would have to vote on the idea they believed was the best explaining why they preferred that particular idea.
Due tu the limited participants this activity was not made.

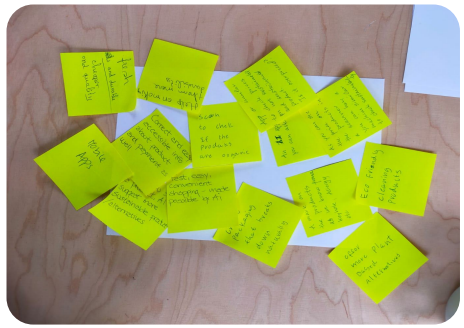
Workshops Reflections

The planned workshop was not conducted as expected due to low participation, which was influenced by several factors. The outreach was limited to friends, and it was not planned with much time in advance. As a result, most were unable to attend, as they were busy with classes, work, or academic projects. Although a larger number of participants initially confirmed, some canceled the days before.
It is understood that things do not always go as planned. However, it is important to have alternative approaches in place or be prepared

to adjust and adapt as needed to ensure the process continues smoothly and objectives are still met (Walker, Haasnoot & Kwakkel, 2013). Reflecting on the experience, several adjustments could have been implemented to improve participation such as a broader recruitment strategy, reaching beyond personal contacts, adding posters in strategic places to attracted a more diverse group, although previous academic efforts showed that even with catchy posters in strategic places, recruitment numbers were low. Promoting the workshop earlier would have provided participants more time to adjust their schedules. Furthermore, offering an online option could have increased engagement, as two participants mentioned they could attend virtually, reducing the time needed for dislocating. These changes might have led to better participation and a more successful workshop.

This considerations would be in mind when planning another workshop for testing the possible solution (Chapter 9).

Consequently, an alternative solution was thought, and the assumptions were tested using another method to achieve the intended goals (Chapter 5.5).



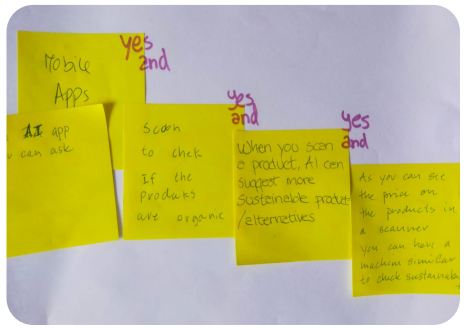


Figure 20 - Activity 2: Create your Dietary Profile Template

Figure 21 - Activity 3: Create your AI superhero: Step 1

Figure 22 - Activity 3: Create your AI Superhero: Step 2

Figure 23 - Create your AI Superhero: Final result

5.5 Testing Assumptions

It is assumed that gamification can effectively encourage users to make more sustainable choices by offering incentives such as points, discounts, or prizes. These rewards increase the probability that consumers will opt for eco-friendly products. From literature review it was validated that gamification has become increasingly popular across different aspects of daily life, including education and transportation (Lin et al., 2023). The success of gamification is largely driven by the presence of rewards, which are crucial for maintaining user motivation. Without incentives, user engagement tends to decrease (Lin et al., 2023). To sustain this engagement, it is essential for systems to offer clear, defined goals that challenge users, encouraging more active participation (Flatla et al., 2011).

Gamification have also increased to enhance and improve consumer experiences (Mulcahy et al., 2021). The integration of game design elements brings fun and enjoyment to tasks that are typically viewed as routine (Mulcahy et al., 2021). Gamification, as defined by Deterding et al. (2011), involves "the use of game design elements in non-game contexts," a concept further emphasized by Treiblmaier et al. (2018), who highlight its ability to boost motivation in diverse non-game systems.

Research by Lin et al. (2023) shows that gamified experiences can positively influence customer attitudes and behaviour. Increased engagement through gamification leads to higher levels of customer loyalty, positive word-of-mouth marketing, and greater customer satisfaction (Lin et al., 2023).

This is evident in Portuguese supermarkets like Pingo Doce. (n.d.) where users are rewarded for spending over a certain amount at that supermarket chain. The rewards range from product baskets, prize draws with the possibility of winning a car, to earned points being able to be exchanged for fuel at some gas

stations. This marketing strategy effectively drives consumer behaviour, encouraging shoppers to choose a particular supermarket chain due to the benefits offered. This illustrates how gamification and rewards can not only drive consumer loyalty but also encourage more sustainable choices when integrated into shopping behaviours.
By making sustainable choices more engaging and rewarding, users are more likely to select eco-friendly products, knowing they may receive a prize or discounts.

Additionally, it is assumed that users have diverse needs and varying familiarity with the sustainable values of products. This was evident not only in the workshop (Chapter 5.4) but it was reinforced in the User Observation method used in the initial research phase (Chapter 4.2), where individuals followed different diets and held varying concerns about sustainability. The initial survey with 50 respondents (Chapter 4.1) also revealed differences in responses to food-related issues, particularly from questions three to six (Appendix 1). The combination of this responses underscore the need for personalised solutions, as preferences regarding sustainability, health, and food safety differ among users.

It is also assumed that users are more likely to adopt sustainable practices when they understand the reasoning behind them. Survey analysis and previous literature suggest that while many people express a desire to make sustainable choices, they often lack the necessary information on product labels to make informed decisions. Research suggests that promoting adoption of sustainable practices involves minimising the effort users need to invest (e.g in terms of information seeking) (Tate, Ellram & Dooley, 2014) while also showing how these practices align with their personal goals (Pannell et al., n.d.).

Another assumption is that the target group is familiar with AI, as many individuals in today's technological era use mobile apps, virtual assistants like Alexa, and chatbots regularly. Research reveal that AI has become everywhere in modern society, with adoption in everyday technologies (Campolo et al., 2017). Studies also have shown that younger generations, particularly Generation Z, display a strong intention to use AI technologies in various aspects of their learning processes. Students report that AI chatbots improve the efficiency of academic tasks and find these tools both accessible and easy to interact with (Chan and Lee, 2023). Additionally, research indicates that future generations are expected to adopt AI tools more voluntarily than older generations, due to having grown up in an era where AI technologies are inserted in most digital devices and services (Schei, Møgelvang, and Ludvigsen, 2024). Although my target group is not just focused on the future generations, but also in the actual eco-conscious individuals that want to be empowered to do more sustainable grocery shopping this studies suggests that implementing AI-based solutions will be well-received and likely easily adopted by users as AI technologies are available to individuals from various backgrounds, including students, working professionals, and the elderly (Gaur & Gaur, 2023).

5.6 Redefining the Focus

After all the research methods used to understand the user needs it became clear that it was essential for to determine exactly what information should be provided to the users. The focus shifted to understanding what specific information users were seeking.
After re-analysing the responses from the open-ended question and reviewing the insights from the previous survey and user observation, it became clear that a deeper understanding was needed regarding the source of this information.
The patterns in these responses, along with some individual ones, revealed that the concerns are based on issues such as not knowing which products are locally sourced, the energy usage, the plastic packagings, and concerns about greenwashing brands (Figure 24).
This observation led to the decision to focus on SCT (Supply Chain Transparency).
It was determined that the focus should be on the Supply Chain Transparency (SCT) information of the products. For instance, one response from the open-ended question highlighted the need for more information about how a product is sourced, while also expressing concerns about energy consumption and off-season harvesting practices (Figure 25).

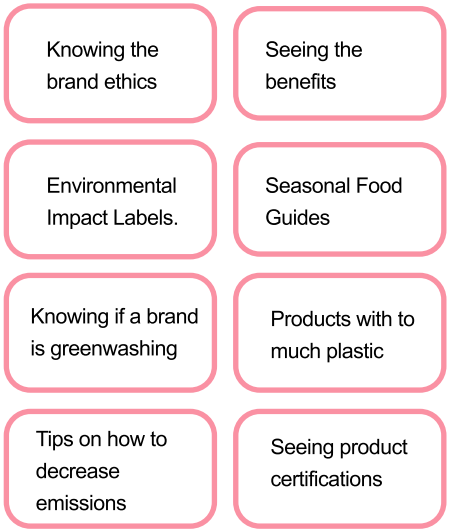


Figure 24 - Some patterns on the survey's last two questions that helped deciding the focus of the project

"I would ask AI what products are being harvested in the current season to **avoid supporting energy waste** in off season products harvesting (i.e strawberries in winter or kiwis in summer)"
- Miguel

Figure 25 - Response to the open end question

A New 'How Might We' Question

The focus has now shifted towards not only providing users with essential knowledge but placing a greater emphasis on the supply chain transparency (SCT) values of the products. With this a new how might we question (Figure 26) was formulated that suggests that the users will be provided with the critical information necessary to make informed and conscious decisions. The goal is to give them not only information about nutrition values but also the origins of the products they purchase, how these products are produced, and the environmental impact involved in their creation. This approach aims to empower users by offering transparency on key factors such as sourcing, manufacturing processes, and the associated environmental costs.

"How might we provide supply chain transparency to empower users in making informed and sustainable choices when selecting grocery products?"

Figure. 26 - Final HMW Question

5.7 Exploring SCT information

Sources of SCT information

This research is directed at examining the accessibility of supply chain information for consumers and to identify where this information can typically be found to identify whether it is easily available.

Based on desk research supply chain details are sometimes displayed directly on product **labels and packaging**, including sourcing and certification information. However, as noted in previous findings (Chapter 4.1.1), surveys have indicated that this information is often unclear or difficult to interpret.
FoodPrint (2024) explains that certain labels, such as "USDA Organic Certification" or "Animal Welfare Approved," clearly indicate that specific certification requirements have been met. In contrast, terms like "Pasture Raised" suggest certain practices but do not guarantee full compliance with specific standards. Therefore, a need for general standardisation, or at least improved education, has been identified to ensure that individuals are better equipped to understand and differentiate between various certifications and labels. Improving access to this knowledge would empower consumers to make more informed and sustainable choices, thereby promoting responsible consumption habits.
Some **mobile apps are already incorporated with QR** code scanners allowing users to find more data about a product as observed in chapter 5.2, however, it has been observed that this apps mostly present the nutrition values or the ingredients of the products e.g Fooducate app (Fooducate. n.d), but they still don't present SCT information.
Brands websites can also offer SCT information in dedicated sections on providing insights into sourcing, production, and sustainability practices. As an example, the Ben & Jerry's brand includes on its Values and Mission page detailed explanations about its commitment to various social and environmental causes. The page outlines their dedication to using Fairtrade-certified ingredients, supporting small-scale farmers, and sourcing non-GMO ingredients (Ben & Jerry's, n.d.). While this enables a deeper understanding of products origins and production processes, it is time-consuming for users to navigate through individual websites, which often provide more general brand

mission and goals rather than specific product details. Additionally, not all websites provide this level of information, and in general, the less sustainable a brand is, the less likely it is that such transparency will be available on its website.

Certifications and Non-Governmental Organisations (NGOs) are also frequently associated with providing supply chain information, although their focus often extends beyond the food industry. For example, Transparency International (2024) primarily addresses SCT values in the context of combating corruption. Similarly, Greenpeace (2024) promotes transparent and sustainable practices across industries but does not specifically focus on grocery product supply chains.

Insights into supply chain practices can also be accessed via **social media platforms**, where brands and consumers can share transparency and ethical practices. Additionally, consumers can obtain supply chain information by **directly contacting** companies through customer service channels.

Exploring users sources for finding product Information

A second open question was made to the same individuals, that have answered to the first question but this time to understand where do they usually find information about the products. It was giving them the option to choose from the previous highlighted (product labels, apps, brand websites, NGOs, social media or direct contact to the brand). From the twelve responses, eight indicated that they mainly find it on the product (e.g. labels), three stated that they cannot find it anywhere, and one mentioned the brand website (Figure 27).

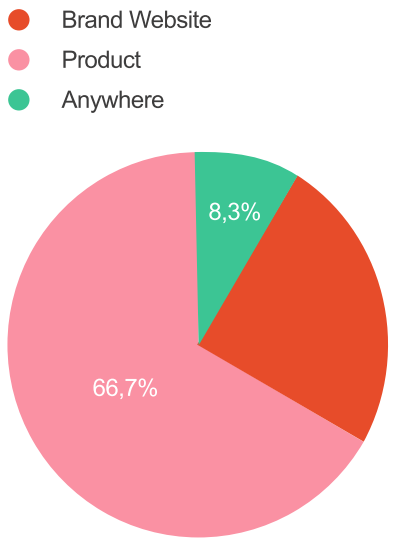


Figure. 27 - Where users usually find product information.

Existing AI Services for Obtaining SCT Information

This time the research has been conducted to analyse existing AI services to help users obtain SCT information of products. The purpose of this research was to identify what solutions already exist, how they work and to gain inspiration for developing a future project solution.

Several platforms were identified for this purpose, including **Provenance**, a website and mobile app, that provides supply chain transparency by using blockchain to verify the authenticity of products, allowing consumers to trace the journey of products from source to store, including sustainability practices. Provenance is a useful tool for brands (not only focus on food products) aiming to offer greater supply chain transparency and meet consumer demand for ethical and sustainable products (Provenance, n.d.).

Good On You is a service for the fashion industry that rates brands based on their environmental impact, labor practices, and animal welfare, offering transparency to consumers about the ethics behind their purchases (Good On You, n.d.).

HowGood offers a database of food products, rated based on sustainability factors such as environmental impact, labor practices, and sourcing. It also includes supply chain mapping enabling companies to achieve greater visibility into their indirect supply chains, tracing them back to the origins of raw materials (How Good, n.d).

Buycott allows users to scan product barcodes to learn about a company's practices on human rights and environmental sustainability, but it is noted to not be the most user-friendly app (Buycott, n.d.).

OpenSC uses technologys to track the supply chain of food products, ensuring ethical sourcing and low-carbon production verification (OpenSC, n.d.).

Sourcemap enables companies to map their entire supply chain and share the information with consumers (Sourcemap, n.d).

TrusTrace Its a traceability platform for fashion, footwear, and textiles to analyse data, assess sourcing risks, and implement shipment tracking. It gathers data directly from suppliers and integrate it with supply chain tools to ensure compliance with

regulatory reporting requirements. (TrustTrace, n.d).

By analysing these existing services, it became clear that some of them are not very user-friendly or easily understood without prior knowledge of the topic, and it was also observed that this lack of knowledge is a key barrier for individuals. Additionally, these platforms often present an overwhelming amount of information, which can contribute to confusion rather than clarity. When developing a solution, some important considerations include offering only the essential information, with the option to personalise content based on individual user preferences. Additionally, the information should be presented in a visually intuitive way, using graphics and other simplified methods to enable quicker and easier interpretation. This ensures that users can access relevant details without feeling overwhelmed, while still having the ability to tailor the experience to their specific needs.

CHAPTER 6

Engaging Stakeholders

6.1 Mapping Stakeholders

The stakeholder map is a fundamental tool in service design, offering a visual overview of the stakeholders involved in a system and their relationships (Dam & Siang, n.d.), and it helps in identifying potential challenges and highlights how closely each actor interacts with the user within the service environment (Giordano et al., 2018). In this case, the stakeholder map (Figure 28) is used to illustrate the varying levels of proximity of stakeholders involved in providing the SCT information to the user, with the map highlighting the different actors and their roles in facilitating this information. At the center of the map are the users, who represent the project's target group. This reflects the primary aim of providing them with the necessary SCT information to enable informed decision-making.
In the first circle, representing direct interactions, are brands/suppliers and supermarkets (retailers). Brands and suppliers have been combined because many brands function as both suppliers and producers.
The supermarkets (retailers), serve as crucial intermediaries between users and the rest of the supply chain by presenting SCT information to them trough the product displays at the supermarket spaces.
The second circle, which represents indirect interactions, have certifying organisations, NGOs and logistic providers. Their interaction with the users is more indirect, as they typically don't provide information directly to the users but trough brands or retailers.
The third circle, also considered indirect interactions, includes the governmental agencies that play a supportive or regulatory role in promoting SCT but do not directly interact with consumers or share information about supply chain transparency.
The arrows on the map illustrate the flow of information between these different stakeholders, showing how SCT data moves through the supply chain and reaches consumers, either directly or indirectly.

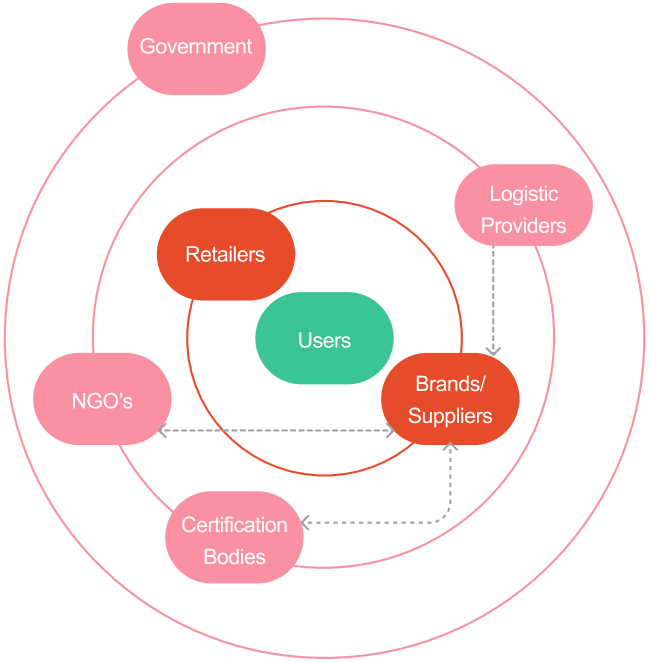


Figure. 28- Stakeholders Map

6.2 Data from new Stakeholders

It was considered essential to involve additional stakeholders beyond the users to gather more comprehensive data and insights before developing a solution focused on providing SCT information. The purpose of involving these stakeholders is to help identify practical barriers and challenges on providing SCT information.
For further information gathering, two key stakeholders were selected, brands and producers (suppliers) and supermarkets (retailers). Brands and producers were prioritised because they are positioned at the start of the supply chain and are crucial in providing essential data about sourcing, production methods, and sustainability practices. Without their transparency, it would be impossible for other actors, including retailers and users, to access critical SCT information.
Secondly, supermarkets (retailers) were chosen as they are positioned at the end of the supply chain and are partially responsible for how SCT information is presented to the users. Serving as the primary connection between products and users. Engaging with them provides insights into whether consumer demand justifies the effort and cost of providing SCT data, the logistical challenges of managing and presenting such information, and their willingness to push for greater transparency from suppliers.

Why These Two Stakeholders?

Involving both suppliers and retailers (Figure 29) allows for a complete understanding of the supply chain. Suppliers can explain why certain SCT data might be unavailable, while retailers can offer insights into how and why this information is or isn't presented to the users.
Gathering perspectives from these key actors enables a more informed and realistic development of a solution. By understanding the challenges faced in both production and retail, it becomes easier to address obstacles at different points in the supply chain ensuring that the solution is practical and effective.
This approach ensures that the solution is developed with a deeper understanding of the needs and challenges faced by both ends of the supply chain.

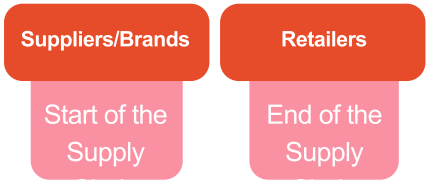


Figure. 29 - Chosen stakeholders to involve in the project

Collecting Perspectives from New Stakeholders

A survey was conducted to gather insights from both sustainable and less sustainable brands and supermarket managers to gain a broader perspective on the SCT challenges.
A total of 19 different companies were approached by email (Appendix 4), but only two responses were received, both from sustainable brands. While the intention was to get a balanced view from both sustainable and less sustainable companies, it was easier to contact and receive feedback from sustainable brands, as they may be more open to engaging in conversations about transparency.
It is acknowledged that reaching companies for such surveys can be challenging, as businesses often have many priorities and limited time for responding to external research requests.

The survey goal was to gather insights from both supermarket managers and brand representatives on SCT. The survey questions (Appendix 4) were thought to explore the challenges these different stakeholders face in providing transparency, as well as their views on the increasing consumer demand for sustainable practices.
The primary focus was to understand their perspective on the current demand for SCT, the challenges they face in achieving full transparency, and how they implement SCT in their strategies. Additionally, it also served to uncover their perspectives on how SCT information influences consumer behaviour. Another area explored was the reasons behind the challenges in achieving complete transparency and the steps they believe would be necessary to address these barriers.

The questions were designed to provide a deeper understanding of the type of information companies currently offer, the difficulties they face in achieving full transparency, and how they see integrating AI to support the optimisation of SCT information.

Reflection on engaging with new stakeholders

Overall, it was found that obtaining

contact details for CEOs and supermarket managers was more difficult than anticipated, particularly compared to contacting representatives from brands. However, it was concluded that gaining the perspective of producers and brands was more important, than supermarkets, as the are at the end of the supply chain, having less influence on providing SCT information then the brands.
Even so an attempt was made to engage with Salling Group, Denmark's largest grocery chain and initial attempts to reach out were directed at managers and relevant employees via LinkedIn. However, without a LinkedIn Premium account, it was not possible to send direct messages to them.
To address this issue, Hunter.io was used to locate email addresses, which successfully led to finding the email of CEO Peter Bang.
Additionally, contact information was found on the Salling Group website but due to the high volume of student inquiries, responses could not be guaranteed. Only a general customer service number was provided, which was not suitable for reaching individuals with the necessary expertise.
A Danish website, Økologisk Landsforening (n.d.), was used to find information and email addresses of sustainable Danish brands. This website proved to be very helpful in locating contact details, and emails were sent to several brands in hopes of receiving survey responses, though it was acknowledged that obtaining replies could be challenging.
Attempts were also made to contact less sustainable brands understood that responses might be even more difficult to obtain. This could be because these brands may not prioritise transparency or sustainability, making them less inclined to participate in such surveys.

Analysing Survey Answers

After the survey was conducted the answers were analysed to extract insights that could be useful for reflection and brainstorming solutions enhancing supply chain transparency even though only two responses were received from Sustainable Danish Brands. Despite the limited feedback some answers (Figure 30) were interesting and fostered ideas.

Question: What specific actions or policies (from governments or consumers) would motivate your company to invest more in supply chain transparency?

Answer: “That all the sectors come to us and see how we do things.”
- Gram & Nybøl Godser, Owner

This response highlights the importance of collaboration across different sectors, suggesting that transparency could be fostered through shared experiences. One possible solution could involve the development of an app that showcases the sustainable practices of different brands. For example, when a product is scanned by a user, a “See More” button could present a visual and user-friendly display of the brand’s sustainability practices and values.

Question: What do you think needs to happen in the industry to make supply chain transparency a standard practice?

Answer: “That we trust each other and find out that the more we share and are transparent, the more we can grow.”
- Gram & Nybøl Godser, Owner

Answer: “Regulatory push.”
- LA International ApS, CEO

This first response emphasises the necessity of trust and open communication within the industry. To enhance credibility, a “verified” icon could be integrated into products information, to indicate that the information about sustainable practices is trustworthy and accurate that could build consumer trust.
The second answer highlights the belief that government are needed to make SCT a standard practice. These regulations could include mandatory rules for reducing carbon emissions, ensuring sustainable sourcing, and show SCT details.
A regulatory approach could influence companies that may not voluntarily take steps toward transparency. By making these practices mandatory, industries would be required to

Figure. 30 - Questions from Survey that allowed further reflection

integrate sustainable practices and communicate transparently about their supply chains to meet regulatory standards.

6.3 Amplifying the exploration

Exploring Sustainability and Information Transparency in Supermarkets

A combination of field research, desk and literature research was employed to explore the availability of sustainable products and the transparency of information provided in supermarkets. This process involved reviewing the websites and sustainability reports of different danish supermarket chains, including Rema, Føtex, and Netto, as well as conducting on-site observations in these stores.
Field research, as described by Burgess (2003), is characterised by observing and analys ing real-life situations. The methodology used for this research was rooted in the works of Wax (1971) and Douglas (1976), who emphasized the importance of studying actions and activities as they happen. By visiting different supermarkets and examining the sustainability information on product labels, real-world data was collected, offering valuable insights that align with the principles of field research (Burgess, 2003).
In parallel, desk research revealed a general focus on sustainability across all supermarket groups examined. Supermarkets like Rema 1000, Føtex, and Netto have demonstrated their commitment to addressing environmental concerns through various sustainability initiatives and reports. This trend reinforce the increasing importance of sustainability in the food industry.
For instance, the Salling Group, which owns Netto and Føtex, has made efforts to significantly reduce emissions from their operations. Their goal is to ensure that any remaining greenhouse gases are naturally absorbed and stored, thereby promoting a balanced approach to environmental responsibility (Salling Group, n.d.). Meanwhile, REMA 1000 strives to provide affordable goods without compromising on quality, environmental sustainability, or the welfare of humans and animals. Their slogan, "discount with an attitude," reflects their daily efforts to achieve these goals (REMA 1000, n.d.).
REMA 1000's Corporate Social Responsibility Report further highlights their ongoing efforts to reduce CO2 emissions, minimise resource consumption, and lower waste, all while promoting a circular economy. Additionally, their commitment to biodiversity was demonstrated by the planting of 30 hectares of land in 2023 (REMA 1000, 2023).

Recent research highlights the growing importance of information transparency in promoting sustainability within supermarkets. Consumers are showing an increasing demand for information regarding food safety, product origin, and sustainability (Wognum et al., 2011; Rita and Ramos, 2022).Transparency and traceability have become essential requirements as consumers, investors, NGOs, and government agencies seek to understand the contents and origins of the products placed on the market (iPoint Systems, n.d.). Supply Chain Transparency involves companies sharing information about their supply chain operations and product compliance, which helps foster trust among different stakeholders (Sodhi & Tang, 2018). In response to rising consumer interest in knowing how and where products are made (Kraft & Zheng, 2021), companies are required to find efficient ways to gain visibility into their supply chains to meet the increasing demands from regulators, consumers, activists, and investors, despite the vast resources this commitment may require (Zheng, 2021).

The Role of Brand Transparency in Consumer Purchasing Decisions

"Over 90% of consumers say transparency by a brand is important to their purchase decisions."
(Emarsys, 2021).

This emphasis on transparency is particularly evident in the food industry, where sustainable and ethical practices are becoming increasingly important to consumers. Organisations are being pressured to demonstrate sustainable developments with these demands being driven by consumers, governments, media and investors (Sánchez-Flores et al., 2020).
Research has shown that rising income levels, along with greater awareness of health, social, and environmental consequences, have led to increased global demand for diverse and safe food products, such as organic, eco-friendly, and nutritious options (Wu et al., 2021).
Branding, marketing, and advertising have been used to communicate qualities such as safety, nutrition, sustainability, and ethical standards but the growing complexity and

globalisation of food systems have increased the risks of fraud and food safety issues.(Wu et al., 2021). As a result, consumers increasingly rely on clear, trustworthy information to guide their purchasing decisions.
The importance of transparency is further emphasised by research showing that sustainability labels play a significant role in shaping consumer behaviour. Cook et al. (2023) found that consumers are willing to pay extra for products labeled with clear sustainability indicators, but the effectiveness of these labels largely depends on how easily the information is understood and trusted. Moreover, transparency is widely recognised as a central factor in fostering strong customer relationships. It is believed that improving transparency throughout all stages of production is essential for promoting sustainability, as a lack of accessible information can lead to uncertainty and hesitation among consumers. When transparency is lacking, it becomes one of the most significant factors affecting purchasing decisions (Wiederhold and Martinez, 2018). This observation is supported by Tan et al. (2022), who noted that transparency is vital for building consumer trust.
Studies also suggest that trust significantly increases the probability of consumers committing to purchases (Schlosser et al., 2006), as such, companies that prioritise transparency and build trust are better positioned to influence consumer behaviour and achieve sustainable growth.

Environmental and Technological Challenges in Food Supply Chains

Industrial farming has emerged as a significant contributor to greenhouse gas emissions, pollution, and species extinction (Sustainable Food Trust, 2024). To mitigate these environmental issues, there has been a growing trend toward redesigning food products to enhance sustainability (Sustainable Food Trust, 2024). This shift aligns with the increasing emphasis on supply chain transparency, which enables consumers to make informed choices by verifying sustainability claims.
Supply chain quality management is critical to achieving these goals. Effective management practices, as explored by Sunmola, Burgess, and Wertheim-Heck (2024), involve processes that ensure products meet high-quality standards, reflecting the broader need for transparency and sustainability in food production.
According to the Global Farm Metric (n.d.), standardised metrics are essential for assessing farming practices and environmental impacts. By integrating these metrics into SCT consumers can access reliable data about the environmental footprint of their food, thereby supporting more sustainable purchasing decisions. This growing consumer demand for sustainably sourced products emphasises the need for strong supply chain management systems (Wijesooriya, 2024). However, achieving this requires aligning regulations across regions to standardise how food information is tracked and shared.

6.4 Sustainable Values Through SCT

The alignment of SCT initiatives with the Sustainable Development Goals (SDGs) (United Nations, n.d.) is critical to addressing the complex environmental, social, and economic challenges facing the world. This project focuses on enhancing transparency in supply chains, aligning with three specific SDGs (Figure 31):

Goal 12 - Responsible Consumption and Production;
Goal 13 - Climate Action;
Goal 17 - Partnerships for the Goals.

Figure 31 - United Nations SDGs Available at: https://sdgs.un.org/goals)

SDG 12: Responsible Consumption and Production

This goal encourages companies, particularly large corporations, to adopt sustainable practices and integrate sustainability information into their reporting cycles (United Nations, 2015). The project supports this goal by providing users with detailed SCT information about the environmental and social impacts of products, thereby empowering consumers to make responsible purchasing decisions. By focusing on transparency, this project contributes to the principal goals of SDG 12, fostering more sustainable consumption practices through informed decision-making.

SDG 13: Climate Action

The urgent need to combat climate change, as supported in SDG 13 (United Nations, n.d.), is supported by SCT initiatives that expose the carbon footprint and environmental impact of products. Transparency enables both consumers and corporations to make data-driven, climate-conscious decisions that reduce emissions and promote sustainable practices. For example, SCT data can reveal the greenhouse gas emissions associated with product transportation and production, encouraging brands to adopt renewable energy sources and low-carbon supply chains. This project directly aligns with the goals of SDG 13 by making environmental impacts visible, encouraging emissions reductions across supply chains and promoting climate-friendly consumer behaviour.

SDG 17: Partnerships for the Goals

The goal emphasises the importance of partnerships in achieving the broader SDGs (United Nations, n.d.). Effective SCT relies on collaboration between multiple stakeholders, including manufacturers, suppliers, regulators, certification bodies, and consumers. This collaborative approach fosters an ecosystem where resources, data, and expertise are shared, leading to more significant advancements in transparency. The project's emphasis on building partnerships aligns with SDG 17, as it creates a network of cooperation, sharing knowledge and best practices for fostering sustainable supply chains and improving overall sustainability metrics.

CHAPTER 7

Building a Solution

Flow for building the Solution

The purpose of this thesis is to establish a service that is designed to encourage users to choose more sustainable brands, and with better and more comprehensive SCT information. Users are expected to make informed decisions, driving the demand for sustainable products. In response, this demand is expected to encourage less sustainable brands to acknowledge the need to improve their sustainability practices to attract more consumers.
This approach aims to provide consumers with the necessary knowledge to make sustainable purchasing decisions, fostering a shift towards more responsible consumer behaviour. Ultimately, this initiative is intended to contribute to a more sustainable future for generations to come by promoting awareness and encouraging positive change within the food industry. The long-term goal is to create a market where sustainability becomes the standard, benefiting both consumers and the environment (Figure 32).

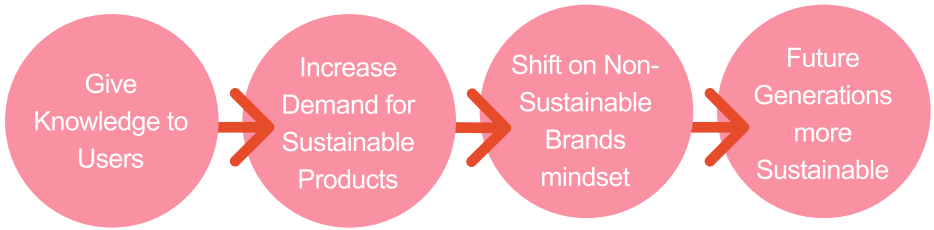


Figure. 32 - Flow of ideas for building a solution

7.1 Developing the solution

The main goal's with the solution are to empower users with the right knowledge to make more sustainable decisions, by giving them SCT information, and at the same time to encourage less sustainable brands to adopt better practices by improving their SCT values.
As mentioned in section 6.3.2, previous research indicates that there has been an increasing demand for sustainable practices among consumers, who are opting for food products that provide greater SCT information. Consequently, if users choose not to purchase items from less sustainable brands, those brands may feel encourage to adapt and improve their practices in order to recover customer trust and loyalty.

First proposal

Reviewing all the insights from all the research process and based on the previous brainstorm ideation made (Chapter 5.3), an initial idea for a possible solution was developed. This idea was initially designed to create an easy-to-use, accessible AI-powered shopping assistant, personalised for each user to be used at the supermarkets. It was thought that at the entrance close to the doors that give access to the grocery shopping isles there would be some shelves with a small gadget that the users could take and use it while grocery shopping inside. During the process the device would scan products via a camera, providing sustainability information of each product to help users make informed decisions. Users could interact with a incorporated chatbot for additional information and receive suggestions based on their sustainability goals. The assistant was also planned to have voice features, allowing users to ask for more details about a product. It would assist in the product decision and also at the checkout by simplifying this process by generating a code that would transferred the product list to the payment system that would reduce the need to scan each product individually during checkout.

How would this idea work?

Device Placement and Usage

The devices were intended to be placed at the entrance of the supermarket, near the shopping carts. They could be activated using a code that users received after registering on the supermarket's

website e.g. To prevent unauthorised access, security measures such as GPS tracking or alarms could have been implemented to ensure the devices were returned after use.

Promotion and Maintenance

Promotion through social media and visually appealing signage at the supermarket entrance would have introduced users to this technology. Clear instructions on how to register and use the system would have been provided, making it accessible and easy to adopt. Supermarket staff would have been responsible for maintaining the devices, ensuring they were available, and managing their return to the designated shelves after checkout.

Payment and Rewards

At the checkout after completing the payment the system would show the environmental impact of their purchases, highlighting the eco-friendly choices made. Rewards and discounts for sustainable purchases could have been automatically added to their profile after payment, offering further incentives for making eco-conscious decisions.

Reflection on this first ideation

The intention was to explore options beyond mobile apps, however, several constraints, such as implementation, maintenance and costs of the gadgets, made this solution less realistic. Additionally, it was reflected that this alternative would not offer significantly more value than what a mobile app can provide and they are also more accessible to users, and given their extensive usage nowadays, they remain a more practical and effective choice.

Iterating on the proposal

With these considerations in mind, a new possible solution was ideated, maintaining some previous ideated features.

The solution was now a mobile app that could used in different supermarkets due to it's GPS localisation feature. Users would be able to visit a supermarket, activate Bluetooth, and select the specific supermarket they were in.
The app would incorporate several features designed to enhance the user experience and promote sustainable practices:

Personalising options, enabling users to filter and view product information, according to their preferences. This

feature can provide users with tailored information that aligns with their values, ensuring their decisions reflect personal priorities.

A product scanning feature: Would present the receiving information about the SCT in a very visual a interactive way. This will not only educate users on the lifecycle and sustainability of products but also make the process enjoyable. The goal is to present the product's sustainability impact in an easy-to-understand, visual format.
Studies indicate that visual presentations can improve both learning and memory retention (Korenman and Peynircioğlu, 2007), while the act of creating visual explanations has been found to significantly assist in comprehending complex concepts (Bobek and Tversky, 2016).

AI-Driven Recommendations:
Based on user's preferences and sustainability goals, AI could suggest alternative brands that are more sustainable and available at the same or nearby supermarkets.

Shopping Cart Feedback:
Before checkout, AI will provide feedback on the sustainability of the user's shopping cart and suggest ways to improve it for future trips.

Users could then choose to edit their cart or proceed to payment.

Payment Process:
Users would have the option to scan products through the app and then choose to either pay directly through the app, similar to the payment options provided by the Bilka app (Bilka, n.d.) or at a cashier with a single barcode generated by the app that could be scanned to finalise the purchase, following the model of existing systems in Denmark, like the Føtex Plus app (Plus, n.d.).

Sustainability Feedback:
During the payment process, users would receive real-time feedback on how their choices impact sustainability, such as how much water or CO2 has been saved with their selections.

Reward System:
After checkout, users would earn points based on how sustainable their shopping choices were. These points could be redeemed for discounts or even donated to local community initiatives, promoting sustainable choices in future purchases.

Community feature:
Where users could share their sustainable tips, and sustainability

achievements, such as how much CO2 they have saved, with friends and other app users. The idea was seen as a way to enhance user commitment and engagement by fostering a sense of community while gamifying the experience and encouraging positive peer influence. The shared data would be analysed by AI to provide personalised recommendations, with users being rewarded with discounts based on their contributions.

Re-evaluating the Features

After evaluating the potential constraints, it became evident that certain features needed to be re-thought to ensure they were both viable and beneficial for all stakeholders.

Initial Idea: Using AI to Recommend Sustainable Products

The next idea considered was using AI to generate a list of sustainable alternatives for users based on their preferences (e.g., local, organic products) or dietary needs. The app would recommend similar products from brands within the same supermarket, offering more sustainable options at comparable prices.

This approach could potentially disturb relationships with suppliers and brands that are less sustainable, as it might push users toward buying from competitors. This is not beneficial for the retailers and instead of suggesting different brands to the users the focus would be on giving them knowledge and information to decide for themselves whether to continue purchasing those items based on their own values and preferences.

Initial Idea: Supermarket localisation Feature

It was proposed that users could use an app that functions similarly to AIRWallet app (AIRWallet. n.d.) used for laundry services, that accurately identifies the user's location, and the app unlocks washing and drying machines at that specific facility. With GPS,Bluetooth, or mobile data, the app could recognise when a user was at a specific supermarket (like Føtex in Carlsberg st. e.g.) This possibility was considered to make it easier for users to only install one app that could be used in different locations and supermarkets and that would also allowed to pay directly on the app.

This solution doesn't add much value, as most supermarkets already have

their own apps that customers are used to. Asking users to switch to a new app could be inconvenient, especially when they would need to create a new account, reinstall an app, and potentially lose accumulated points and benefits in existing systems (e.g., loyalty programs or digital coupons).

Reflections

After consideration it was decided that it would be more efficient to focus on improving an existing supermarket app rather than introducing a new one. The idea is to integrate the SCT information directly into the existing platform, adding more value for users who are already engaged with that app and possibly attract more users and increase overall engagement.

7.2 Exploring Existing App

After careful consideration, the decision was made to focus on the existing Føtex supermarket app as the foundation for the solution. The Føtex app was selected based on prior desk research, which indicated that it aligns well with the target group because they present sustainable brand options while also seeking convenience and variety.

Føtex stores are easily accessible across Copenhagen and Denmark, making sustainable products more accessible.

Sustainability Focus

Føtex has demonstrated a strong commitment to sustainability by expanding its range of organic products, particularly through its ØGO line, which emphasises organic and eco-friendly foods (Salling Group, 2024). Compared to other danish supermarket chains such as Irma or Meny, which focus more on gourmet or luxury sustainable items, Føtex provides a wide selection of sustainable products at competitive prices. This makes it an attractive option for both eco-conscious and budget-aware users. Additionally, the Salling Group's sustainability report outlines their ongoing efforts to reduce their environmental footprint, further supporting the choice of Føtex for this solution.

Exploring the Føtex Plus App Features

To better understand the app's potential, research was conducted through its website, and the Føtex Plus app was downloaded to explore the available features. Subsequently, the features were categorised into

relevant groups to assist in organising existing functionalities and determining how new features could be integrated into the app.

Shopping/product information

Online Shopping Integration: Users can easily browse and purchase items through Føtex's online store.

Barcode Scanning: This feature allows users to scan barcodes for quick access to product details (nutritional information, ingredients and prices).

Personalised Offers: Ensures that users receive offers relevant to their individual shopping preferences.

Shopping Cart: Users can create and edit shopping lists directly within the app.

Reward features

Points and Rewards: Users can collect points and earn rewards for their purchases.

Digital Coupons and Discounts: Users can access digital coupons and special offers directly through the app.

Discounts: App users benefit from discounts on many products.

Promotions and Campaigns: Information about current promotions helps users stay updated on the latest deals.

Payment/Refunds

QR Code for Easy Payment: The can generate a QR for easier and faster payment at checkout machines.

Refunds: Users can upload proof of product issues and request refunds through the app.

Profile and settings

Language Option: The app only supports the Danish language.

Store Locator: This feature helps users find the nearest Føtex stores

Profile: To create a profile, users are only required to provide their name and email, simplifying the setup process.

7.3 Upgrading some Existing Features

Barcode Scanning

Although Føtex app already includes a barcode scanning feature, allowing users to quickly access product details and prices, to align with the project's sustainability goals, this feature can be improved. When a product is scanned, SCT data such as environmental impact, carbon footprint, and ethical sourcing practices can be provided. Users can filter this information to only view what is most relevant to them.

Improved Feature:

The app could not only provide SCT data but also notify users when a brand they usually purchase updates its sustainability data, enhancing transparency and building trust. These updates would keep consumers informed of recent changes in sourcing, production, or certification processes, offering a more dynamic shopping experience.

Constraints and Possibilities:

A major constraint is that many brands do not fully disclose their environmental or ethical impact due to insufficient regulations or the desire to maintain a positive image (Schäfer, 2022). This lack of transparency makes it difficult to verify claims, which could lead to misinformation. Collaborations with third-party certifications (e.g., Fair Trade or Organic) and blockchain traceability could help overcome this limitation (Fraser, Müller & Schwarzkopf, 2020). One assumption is that brands with strong sustainability values would be willing to share this information. An example of this can be seen on the Provenance platforms (Provenance, n.d), where sustainable brands seek to showcase their commitment to transparency and provide detailed information about their practices. This platform effectively highlights how brands can benefit from promoting their sustainability initiatives, encouraging consumers to make informed choices. However, some brands may choose not to disclose their sustainability practices if they do not meet high standards. This is not necessarily a problem for the project, as its purpose is to provide transparency for users, allowing them to make informed decisions. If consumers are more aware of the sustainability efforts of certain brands, they can choose to support those that align with their values.

Blockchain as a Solution for Supply Chain Transparency

Blockchain technology has the potential to address many challenges within food supply chains. By providing a secure system for tracking food products from farm to fork, blockchain can enhance both traceability and transparency (Eze et al., 2024). It allows data securely recorded, giving users real-time access to information about the origins and handling of their food (Wijesooriya, 2024).
The blockchain-based system is particularly valuable for addressing user concerns about the authenticity of organic foods. As more retailers offer organic products, consumers face difficulty verifying the legitimacy of such claims. Blockchain offers a transparent and auditable record that helps verify organic certifications (Wijesooriya, 2024). This not only satisfies growing consumer demands for healthier and safer food but also supports the industry's shift towards sustainable practices.

Case Study: Carrefour's Blockchain Implementation

An example of successful blockchain implementation in the food industry is Carrefour's initiative. The global hypermarket chain adopted blockchain technology to trace products from farm to store, allowing consumers to scan a code on the package to access detailed information about the product's origin, production methods, and safety standards (Eze et al., 2024). This initiative demonstrates how blockchain can build trust by providing transparency in food sourcing and production.

Points Rewards System

The Føtex app already allows users to collect points and earn rewards for their purchases based on their spending. These points contribute to exclusive discounts and special offers

Improved Feature:

To add more value to this feature based on the project goals, rewards could be tied to sustainability. Users receive additional points based on how sustainable their purchases are. Again, the availability and accuracy of sustainability data from brands would be critical for this feature to function effectively.

Shopping Cart Feature

The app has integrated a digital shopping cart that allows users to add products and add them to the cart.

Improved Feature:

The cart could be enhanced to show users the environmental impact of their chosen products. For instance, it could display how much water or CO2 is being saved by selecting certain products.

Language Option

The app is currently available only in Danish.

Improved Feature:

Offering the app in English would make it more accessible to more users, particularly non danish speakers living in Denmark. This inclusion could empower more users to make eco-friendly choices, ultimately supporting a more sustainable future.

7.4 Developing new features for the app

Based on previous ideation, assumptions and research it was decided that could be beneficial to gamify the app and incorporate a community space where users could inspire each other to make sustainable choices, fostering a sense of community in their efforts toward a better future. This initiative aims to connect like-minded users, allowing them to share achievements, and encourage others to do the same.
The concept of community engagement has been shown to enhance motivation and commitment to sustainability, highlighting the importance of social support in driving positive environmental actions (Too and Bajracharya, 2015).

Community Space

The feature intends to bring engagement around sustainable shopping. Users could feel connected with like minded, share achievements, and participate in challenges to encourage eco-friendly habits. This would create a sense of belonging and motivation by allowing users to see that others are also working towards a more sustainable future. According to Bartolo et al. (2023), feeling part of a community and working towards common goals enhances both personal and community well-being, significantly improving life satisfaction.

What does this feature offer?

The community space offers weekly eco-friendly challenges, the option to share the environmental badges for completed challenges at the users profile, and monthly environmental reports based on their purchases with the option to share them also in the community. Based on users sustainable purchases, environmental status level can also be unlocked (bronze, silver and gold) and visible if decided by the users in their profile. In general this space makes sustainable shopping a collaborative and rewarding experience.

Challenges and Rewards:
AI-generated challenges can motivate users to engage more actively in the app. Notifications can remind users of ongoing challenges and progress, ensuring they stay engaged. The challenges should be different to maintain long-term interest.
When joining a challenge, users can track their progress in real-time, being notified when they have a product that is qualified for completing the challenge and they are rewarded immediately.
Users have the option to continue adding products to their shopping cart if wanted, receiving one point for each sustainable product included. This point system operates independently of their participation in the challenge, ensuring that even those who are not actively engaged in the challenge still have the opportunity to earn rewards for their sustainable choices.

Reflection:

Initially, it was proposed that users would be asked to purchase a specific number of sustainable products (e.g., "Buy at least 3 ethically produced items"). However, after further reflection, it was determined that imposing a strict product quantity might lead to overconsumption. The primary goal is to educate consumers and promote more sustainable choices. Therefore, even if participants are motivated by rewards to engage in the challenges, the ultimate goal of integrating sustainable products into their shopping habits remains achievable. Engaging users through incentives while ensuring they understand the value of sustainable practices can enhance their commitment to making more responsible choices. This approach can help maintain user interest and foster long-term sustainable behaviour.
This aligns with research suggesting that incentivising sustainable behaviour can effectively shift consumer habits, as noted by Too and Bajracharya (2015).

Sharing Achievements:

Users would have the option to share their accomplishments in their profile, similar to social media, and make their profiles visible or private depending on their preference.
Social networks have the power to shape opinions and behaviours by allowing people to share and discuss collective goals (Ausat, 2023). By fostering a sense of belonging and community, this feature can further motivate users to participate in sustainable actions.
The concept of gamification could be employed to keep users engaged and motivated. According to Froling and Nabseth (2017), gamification can effectively increase user participation by turning routine tasks into rewarding and interactive experiences. Weekly challenges, badges, and progress reports would enhance user engagement, making the app more dynamic and enjoyable.
Research also shows that social validation plays a crucial role in influencing user behaviour (Ballara, 2023). When users see others making sustainable choices and receiving recognition for it, they may feel encouraged to do the same.

7.5 Sustainable Guidelines

A major issue identified during this project is how supermarkets can classify food products by their level of sustainability, especially given that different products may have varying information available on the SCT values. Therefore, a guideline was needed to classify products based on the information provided about them. For this project, Føtex will need to establish a set of criteria that classify certain products as more sustainable than others. This is essential for determining which products are eligible for sustainability challenges. Since there is currently no mandatory standardisation from governments regarding the information that products must disclose about SCT, different stakeholders must collaborate closely and share more data to ensure that their products are ethical and sustainable (iPoint Systems, n.d.).

Research into the practices of Leroy Merlin, a home improvement and gardening retailer, revealed an innovative system that scores the sustainability of its products based on SCT information provided. This served as an inspiration for the development of a similar guideline for Føtex but to score their grocery products. Leroy Merlin has developed the "Home Index", which evaluates products based on their environmental and social impact,

such as raw materials, manufacturing, energy consumption, and recyclability. (Leroy Merlin Espana, 2024).

Adaptation of the Existing Guideline

To develop a similar guideline for Føtex for scoring their products based on the SCT information of each product, the framework used by Leroy Merlin was adapted, focusing on SCT values specific to food products.

Seven key parameters were identified, reflecting some of the criteria that Leroy Merlin considers when scoring its products:

Origin of Materials: Information about where raw materials are sourced.

Manufacturing Practices: Data on energy use, emissions, and waste management.

Labor Ethics: Details about labor conditions and fair wages.

Carbon Footprint: Insights into transportation methods and the associated carbon emissions.

Third-Party Certifications: Eco-labels and certifications that ensure alignment with environmental standards.

Packaging: The recyclability or use of recycled materials for packaging.

Scoring Methodology

The scoring system developed for Føtex is adapted from the framework used by Leroy Merlin, with a specific focus on grocery products. While Leroy Merlin's scoring criteria includes a broader group of factors, the Føtex guideline emphasises in the seven parameters mentioned before.

Scoring Scale: The system for scoring is the same as the one Leroy Merlin uses to score its products. Each sustainability parameter is scored on a scale from 0 to 100. In this system, higher scores reflect better sustainability practices. This numeric scale helps users identifying which items are more sustainable.

Consequences for Insufficient Data: If a brand doesn't provide the necessary data for a specific criteria, a penalty of -1 point is applied to the score for that parameter.

Rating System: Similar to the "Home Index" products will be rated on a scale from A to E (Figure 32) based on their accumulated scores from the different sustainability parameters.

Overall Scoring: The final score for each product is determined by sum up the individual scores from all the parameters. For example, in the proposed Føtex sustainability guideline (Figure 34), the maximum total points available across all parameters is 25. This score represents 100% of the sustainability evaluation. Based on the scores achieved for each parameter, a percentage will be calculated to reflect the product's overall sustainability performance.

Final Rating: Based on the overall score number, products will be assigned a letter grade from A to E (Figure 33). This grading scale translates the percentage score into a more user-friendly format, allowing users to easily identify products that meet higher sustainability standards.

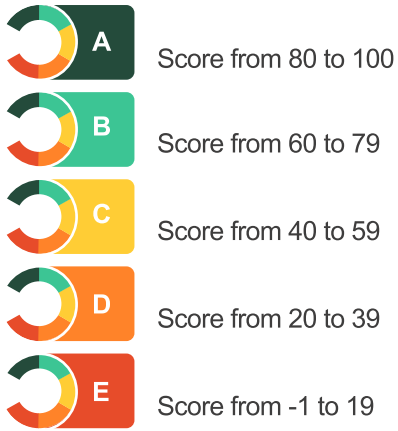


Figure 33 - Scores for the Sustainability Guideline based on "Home Index"

Reflections on the Sustainability Guideline

This framework was consider to be a valuable method to differentiate how sustainable is a product. All the information provided by the app would be based on this values.
While there will inevitably be some brands that are not fully sustainable, this project aims to educate consumers, enabling them to make better choices if they wish to do so.
Furthermore the scoring parameters will need to be reviewed more rigorously for future implementation to ensure accurate classification of products and the prioritisation of the parameters.
Close collaboration between the supermarket, suppliers, and certified bodies or NGOs will also be necessary to gather accurate sustainability data and continuously improve the classification system.
This approach shows the collaborative environment fostered by Leroy Merlin, where suppliers are encouraged to share new data to improve product scores (Leroy Merlin, n.d.).

Consumer Empowerment

For this projects solution, the sustainable guideline will be available to users on the app, allowing them to easily access this tables with detailed explanation of the scoring methods. Clear explanations for each score will educate consumers on what makes a product sustainable, empowering them to make informed purchasing decisions.

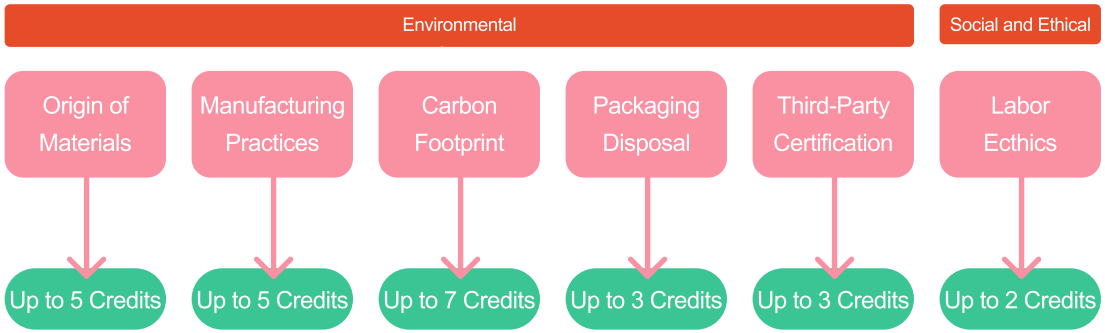


Figure 34 - Føtex Possible Sustainability Guideline (Inspired from Leroy Merlin “Home Index”)

CHAPTER 8

Designing the Experience

8.1 Identifying Transparency driven Platforms

During earlier stages of ideation (Chapter 7.5), research on blockchain technology was explored, and it was initially believed that it would need to be included in the project to make it viable. However, as further research was conducted, standardised platforms were identified as a more suitable solution. It was discovered that many of these platforms already incorporate blockchain, making it unnecessary to include blockchain as a separated actor. Instead, these standardised platforms were viewed as a more effective solution for the project's needs.

From Blockchain to Standardised Platforms

Standards are essential to ensure technical and organisational compatibility between the systems, technologies, data, and companies processes used by different actors. These standards are created through a process that aims to align and align technologies and work practices. Standardised formats are crucial for reducing confusion, ensuring data consistency, and streamlining the collection process across various brands, suppliers, and logistics partners. The data is automatically converted it into a standardised format, covering essential fields such as emissions, energy use, and water consumption. (Costabile, Iden, and Bygstad, 2022). This ensures that data can remain consistently standardised across all brands, simplifying the reporting process. Additionally, automated verification tools can be implemented within these platforms to validate the data before it is passed to other actors.
In the project the brands can submit the data to this standardised platforms e.g Sedex (Sedex, n.d) or IBM Food Trust (IBM, n.d.), for harmonisation and then passed to to certified bodies or NGOs for certification.
Platforms like Sedex highlight the importance of this process. Established in 2001 as a non-profit organisation, Sedex operates the world's largest collaborative platform for sharing responsible sourcing data, allowing businesses to manage information on labour practices, environmental impact, health, and safety. Such platforms enable companies to build more ethical supply chains, identify risks more effectively, align with evolving regulations, and create more resilient supply chains (Sedex, n.d.).

Despite the advantages of standardisation, in order to have the SCT data validated in the project, it remains a need for certified bodies or NGOs since platforms such as Sedex ensure the consistency of collected data, but they don't guarantee the accuracy or reliability of the information provided by the brands. Without verification, the risk exists that brands may manipulate or exaggerate their sustainability claims. Certification by NGOs will add credibility to the data, ensuring that consumers and stakeholders can trust the information presented.
In the final proposed service the brands submit their sustainability information to standardised platforms, that then pass on the info to NGOs that verifies the data before it reaches the environmental manager.
Some standardised platforms already integrate blockchain technology, combining blockchain's traceability with the consistency of a standardisation platform. This integration ensures data transparency and trust across different suppliers (Hellani et al., 2021; Xu et al., 2021; PQSmitra, 2023). Blockchain-based supply chains offer benefits such as environmental sustainability and economic efficiency (Chandan et al., 2023), though these systems require extensive collaboration among companies to track the entire product lifecycle.
Challenges still remain despite these benefits such as integrating data from multiple brands can be technically complex (Najjar et al., 2022). The accuracy of data relies on prior supplier's rigour in tracking their sustainability metrics.
Certification bodies may face challenges in verifying the data if brands are not fully transparent, highlighting the importance of reliable third-party validation (Sarfaty, 2020)."
Additionally, government certification agencies, supported by incentives and clear sustainability criteria, could further encourage responsible production practices (Nandkeolyar and Chen, 2022).
In conclusion, despite some challenges the integration of standardised platforms in the service, in collaboration with third-party certification bodies, has the potential to enhance supply chain transparency. However, its success depends on the integrity of brands and the effectiveness of certification processes in ensuring data accuracy.

8.2 Stakeholders Map

A new stakeholder map was created (Figure 35) to visualise the key stakeholders involved in the final service and to explore potential opportunities (Stickdorn & Schneider, 2012). Initially, the diagram was used to outline the stakeholders identified for the solution, while also highlighting new stakeholders who emerged during further development. The primary focus of the stakeholder map was based on the project's goal of delivering essential SCT information to the users. Stakeholders were organised based on their role in communicating this information, with those positioned closer to the users playing a more direct role.
The users, including current and potential app users, are placed at the center. These users represent both eco-conscious individuals and general Føtex shoppers that can benefit from the solution. The information is accessed directly through the app, which acts as a central touchpoint for users to engage with the sustainability data.
The first circle around the users includes direct contacts like Føtex as a corporate entity, responsible for providing both the platform and the physical products where users find the information. Without Føtex offering these products, users wouldn't be able to scan items and retrieve SCT information.
The brands both sustainable and non-sustainable, are also presented within this circle.
The second circle includes the Information providers also as direct stakeholders. The Føtex environmental manager ensures that accurate sustainability information is communicated through the app. The suppliers play a crucial role by providing SCT data. They are the primary sources of information regarding supply chains, giving information about where products come from and their environmental impacts.
Certification bodies and NGOs, also in this circle validate the data provided by the brands, ensuring the credibility of the information.
The logistic providers are also represented in the same circle because they also provide SCT information from the transportation of product.

Additionally the standardised platforms are intermediaries in the flow of data. They act as data facilitators and validators, ensuring that the information meets specific standards for transparency and accuracy before it is passed on to other stakeholders, such as NGOs and certified bodies.

The third circle represents the support team that includes store employees who indirectly influence sustainability engagement by bridging the gap between app features and real-world customer interactions. The Marketing team that play a role in promoting sustainability features via in store displays and social media campaigns. Finally in the same circle the AI specialists that don't give SCT information directly to the users but Instead, they focus on developing the tools that process, analyse, and score the data according to the sustainability guidelines. Their work indirectly influences SCT information by ensuring accurate data interpretation.

The fourth circle represents the governance and regulation and includes the government that plays an indirect role in setting regulations that require transparency and sustainability standards within the food industry (Kashwani, 2019). These policies align with SCT goals by requiring businesses to disclose environmental data, and the Financial stakeholders, that are also not directly contributing SCT information, but support financially the service, ensuring that sustainable initiatives are maintained.

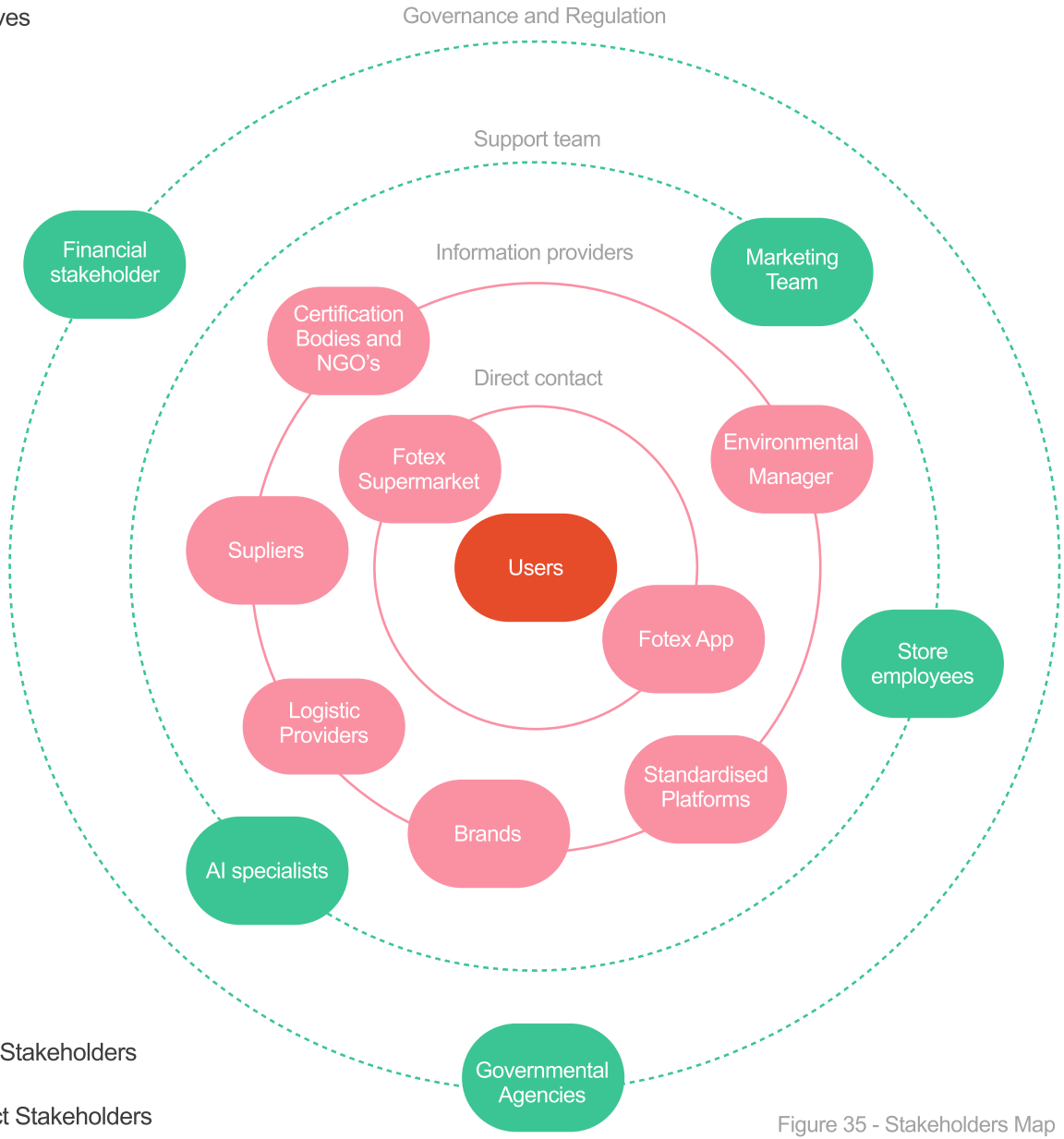


Figure 35 - Stakeholders Map

8.3 User personas

This method was used as a tool for illustrating different user types based on their behaviours and needs, as it allows to categorise users and understand their distinct requirements (Long, 2009). In this project, four fictional personas were created to represent different user scenarios (Interaction Design Foundation, n.d.). Unlike traditional personas, which are grounded in user research, fictional personas are developed through assumptions. These personas help creating hypothesis about user behaviours and explore different design scenarios. By using these profiles, it's possible to anticipate a range of user interactions and tailor solutions to meet hypothetical needs and challenges (Interaction Design Foundation, n.d.).

These fictional personas, despite not emerging from direct user research, provided valuable insights into possible user pain points and needs. This method enabled the exploration and categorisation of user behaviour, offering a framework to address different users and their specific challenges.

The personas developed in this project include:

Magnus (Figure 36): A current Føtex app user who shows little interest in the community space features.

Emma (Figure 37): An active app user who have interest in engaging with the community space feature.

Søren (Figure 38): A non-app user with low interest in the community features.

Line (Figure 39): A non-app user with a strong interest in participating in community-driven sustainability initiatives.

Each persona was designed to highlight specific user needs and pain points, that was further examined through the User Journey Map (Chapter 8.4) to better understand their experience and expectations (Zemke & Bell, 1985).

App user, low interest in community features

Magnus

UX/UI designer
31 years old

Bio

Magnus is an active person who works out regularly and follows a vegetarian diet, focusing on healthy eating. However, he struggles to find vegan and vegetarian products with sufficient information. He already uses the Føtex app near his home in Frederiksberg to find the ingredients and nutrition details of the products and take advantage of discounts.

Motivations and Needs

- Access clear and more detailed product information.
- Would like to know more about the sustainability of the products he likes to buy.
- Earn rewards based on sustainable buying decisions, but without sharing achievements or participating in social features.

Pain Points

- Doesn't want to receive community-related notifications.
- Prefers not to engage in the social aspect of the app, he doesn't want to share in the community space.

Figure 36 - Persona (Magnus)

App user, high interest in community features

Emma

Content Creator
25 years old

Bio

Emma is an extrovert who works in social media and enjoys the sense of community she's built on platforms like Instagram and Tiktok. She uses the Føtex app mainly for discounts and to save time by scanning products herself saving time at the checkout process.

Motivations and Needs

- Engage with users in the community space.
- Participate in challenges and be able to share her achievements.
- Earn rewards and discounts for sustainable shopping while contributing to the community.

Pain Points

- Might feel disconnected if there isn't enough community engagement, she wants to have a sense of accomplishment and belonging through community interactions.

Figure 37 - Persona (Emma)

Non app user, low interest in community features

Søren

Environmental Engineer
35 years old

Bio

Søren doesn't use the Føtex app yet but is aware of it. After hearing about the upgrade, he's curious about the SCT information it offers. Already committed to buying consciously, he's now motivated to try features like product information (SCT) and earning rewards for eco-friendly purchases.

Motivations and Needs

- Prioritising convenience and sustainability without the need for social interaction.
- Discover easy ways to find sustainability data about products.
- Earn rewards for eco-conscious shopping decisions.
- Stay informed on how his purchases impact the environment without needing to join a community.

Pain Points

- Doesn't feel like having the commitment to participate weekly in the challenges and don't want to share his achievements.
- Finds community feature unnecessary.

Figure 38 - Persona (Søren)

Non app user, high interest in community features

Line

Yoga Teacher
33 years old

Bio

Line hasn't downloaded the Føtex app yet but is motivated by the idea of community-driven sustainability challenges. She's looking to connect with like minded eco-conscious shoppers and find inspiration for improving her sustainable habits. She could be encouraged to join if she sees how engaging with the community leads to positive environmental impact and rewards.

Motivations and Needs

- Feel part of a community with like-minded users who care about sustainability (sense of belonging).
- Participate in sustainability challenges that align with her values.
- Learn about sustainable shopping habits and share her own achievements.

Pain Points

- Could feel overwhelmed by too many app features if not introduced gradually.
- May need very good instructions on what makes a product considered more sustainable than the other

Figure 39 - Persona (Line)

User personas Reflections

While personas are recognized as a valuable tool for summarizing user behaviors, needs, and pain points (Long, 2009; Design Foundation, n.d.), it must be acknowledged that they are essentially bias. The creation of personas typically relies on data gathered through interviews, surveys, or desk research. However, the interpretation of this data is subjective, which increases the risk of bias.

Nielsen et al. (2014) emphasise that personas should be developed based on field data, such as surveys, user interviews, and observations. However, although personas are intended to foster empathy and help designers understand users' perspectives, they can unintentionally reinforce stereotypes (Hill et al., 2017).

In this project, the personas were developed using assumptions derived from potential scenarios due to the lack of user data on the exploration of the community feature. To minimise bias, it is essential to validate these personas with real user data and continuously update them as new insights emerge so at this stage it was considered that conducting interviews could have provided valuable insights into user's thoughts about the implementation of this new community feature on the existing app. However, due to time constraints and previous difficulties in encouraging participation in workshops, the interviews were not made.

Although this approach aimed to explore diverse potential user scenarios, the reliance on assumptions ended making them bias that may have cause personas to on personal suppositions rather than in accurate illustration of actual user behaviour (Nielsen et al., 2014). However, the personas were created to illustrate different possible scenarios for both app users and non-users, demonstrating how they might benefit from the app without necessarily engaging with the new features, showing that the solution can be beneficial for both users who are highly committed to purchasing sustainable products and those who are primarily motivated by rewards.

8.4 Quatro Stagioni

The Quattro Stagioni or Scenario Matrix is a deductive method used to develop and describe unpredictable or complex scenarios based on two opposing variables within the scenario framework (Stickdorn et al., 2018). This method was applied in this project to explore how the different users (personas in chapter 8.2) would interact with the Føtex app's features, even if they don't fully engage with all its offerings.
This matrix proved valuable for understanding user behaviour, particularly in relation to their interest in the community space feature and their use of the app. The users were segmented using two variables: App Users vs. Non-App Users and Interested in Community Space vs. Not Interested in Community Space (Figure 40).

The goal of this scenario matrix is to explore variations in user behaviour, understand potential motivations, and identify challenges users may face when interacting with the app. By mapping out these scenarios, possible outcomes and challenges can be better predicted in uncertain or complex situations (Stickdorn et al., 2018).

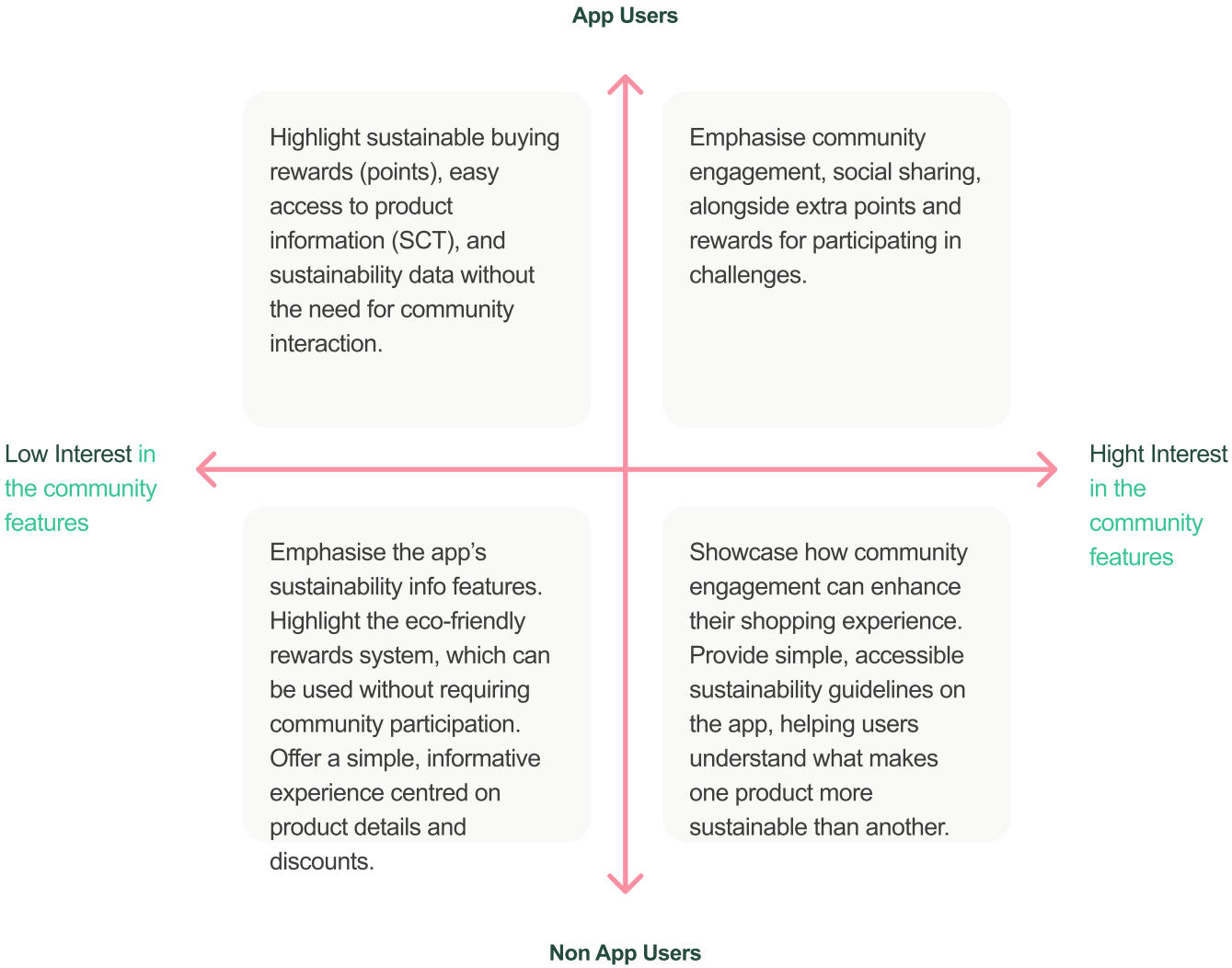


Figure 40 - Quatro Stagioni or (Scenarious Matrix)

App Users and Non App Users, (Low Interest in Community Features)

App users: These users engage with the app for purposes, such as accessing discounts and product information.
Non app users: They are similarly focused on the practical aspects like discounts and product transparency.

Both show little interest in the app's community-based features and prioritise practical benefits like easy access to SCT data.

Value Proposition:
The app provides a simplified and efficient shopping experience, allowing these users to make sustainable choices without requiring active participation in community features. The focus is on providing convenience, offering eco-conscious product information and discounts without needing social engagement.

Value Provided by the App:
These users benefit from the app's main functionalities, including discounts and transparency about product sustainability (SCT). They can make informed decisions quickly, without the need for engagement with interactive or social aspects, such as community challenges.

App Users and Non App Users, High Interest in Community Features

App users: These users not only utilise the app's functional features but are also highly engaged with the interactive community aspects.
Non app users: These potential users have not yet downloaded the app but are interested in its community space. They are drawn to the idea of engaging in discussions about sustainability, participating in challenges, and sharing their eco-friendly accomplishments.

Both will actively participate in challenges, share eco-friendly achievements, and value the app's social engagement features.

Value Proposition:
The app creates a platform for users to connect with like-minded individuals around shared sustainability goals. It fosters a sense of community through collaborative engagement, offering rewards, challenges, and provides a sense of belonging and purpose.

Value Provided by the App:
These users benefit from participating in community challenges, progress tracking, and rewards for sustainable behaviour. Personalised reports and feedback help keep them motivated, enhancing their long-term engagement with the app.

Refections on the Quatro Stagioni

This method made it clear to understand how the app can benefit both current and potential users, even if they have different needs and preferences. It was noted that, regardless of whether users are seeking discounts, product transparency, or sustainability data, significant value can still be gained from the app. The app is flexible and offering value to all users, including those who have little interest in its community features.
The app can adapt to different user needs, making sure it can be beneficial without forcing everyone to use it the same way. This flexibility helps create a strong and diverse user base, allowing the app to fit easily into different lifestyles and preferences.

8.5 User Journey Map

A User Journey Map was employed to visualise the entire user experience by outlining interactions with the service across different touchpoints. This tool helped illustrate the steps users take, their emotional responses, and actions throughout their journey (Stickdorn et al., 2018). It provided a detailed overview of how users interact with the service and highlighted areas where improvements could be made.
Two user journey maps have been created: one for Line, a user who has not yet installed the app but shows interest in engaging with the community features (Figures 41) and one for Magnus, a user who is already using the app but has minimal interest in the community space features (Figure 42). In both maps, the user's actions and the time spent at each stage are illustrated. Emotional indicators have been added to reflect moments of satisfaction or indifference throughout the interactions. These emotional responses have been based on assumptions drawn from the user personas (Chapter 8.2).
Touchpoints were defined to ensure all necessary actions and elements of the service were considered, serving as a checklist to guarantee a smooth service operation.
Opportunities for improvement were identified, focusing on areas where the service could be optimised to enhance the user experience.

Before going to the supermarket

steps	Learning About the Føtex App	Downloading and Installing the App
time	One day before going to the supermarket	After discovering about the app (4 minutes)
actions	Sees an advertisement about the app's sustainable shopping features, including sustainability tracking, QR code scanning, and a community space.	Downloads the app from the app store.
feelings	🤔 Curious about how the app can improve her shopping choices.	😊 Hopeful the app will help her shop sustainably.
touchpoints	Physical: Phone Digital: Social media	Physical: Phone Digital: App Store
opportunities	Show the improved features like sustainability impact scores and rewards. Highlight the new feature (Community space)	Ensure a smooth and quick download process. Include clear images and feature descriptions.

Figure 41 - Line's User journey Map

	Before going to the supermarket				During the groceries shopping
steps	**Sign in/sign up on the app**	Onboarding and Setting Up Preferences	Exploring the App's Features	Joining a challenge	Arriving at the Supermarket
time	Shortly after installing the app. (3 minutes)	After setting up the profile (2 minutes)	Right after onboarding (7 minutes)	(1 minute)	On the afternoon the next day (Few seconds to turn on the mobile data and open the app)
actions	Creates an account and chooses to add profile information and keep the profile visible to other users	Opens the app and sets preferences, including language and sustainability data she prioritises.	Explores the app's features like the barcode scanner, shopping cart, and community space.	Joins the weekly challenge to shop more sustainably, aiming to earn points and be rewarded.	Arrives at Føtex and opens the app to start the challenge
feelings	 Excited	 Appreciates the ability to personalise the app based on her information interests.	 Motivated to explore all features.	 Excited to start the challenge.	 Inspired to shop sustainably.
touchpoints	Physical: Phone Digital: sign in page on the app	Physical: Phone Digital: settings page on the app	Physical: Phone Digital: The main app features	Physical: Phone Digital: Community space section on the app	Physical: Supermarket environment, and phone Digital: App home screen
opportunities	Ensure the account setup is intuitive and easy. Give the option to leave the profile visible or not visible to others	Guarantee onboarding is quick and easy, highlighting how the app can be personalised for each users preferences.	Make sections easy to navigate and offer. Show a demo about the features	Highlight the benefits of completing challenges and make progress visible in real-time.	Motivate the user during the challenge with progress updates

Figure 41 - Line's User journey Map

During the groceries shopping

steps	Scan the products on the app	Add products to cart	Finish shopping cart/Challenge completed	Payment	Immediately Reward
time	While shopping in different aisles. (1 minute each product)	(30 seconds) per product	When finalising her digital shopping cart (2 minutes)	(1 minute)	(1 minute)
actions	Uses the barcode scanner to check product sustainability info, filtering for CO2 and water usage.	Adds products to the shopping cart and sees updates on her environmental impact.	After adding the necessary products to complete the challenge, she is notified of her achievement.	Proceeds to payment, where the app generates a QR code to pay at the cashier.	Receives a badge and points after completing the challenge, which can be redeemed in future purchases.
feelings	😊 Empowered by the detailed sustainability information.	😊 Encouraged to make more sustainable choices.	😊 Enthusiastic about completing the challenge.	😊 Accomplishment	😁 Rewarded for her eco-conscious efforts.
touchpoints	Physical: Product packaging, phone and supermarket Digital: Scanning feature in the app	Physical: Phone Digital: Digital cart	Physical: Phone Digital: Digital shopping cart on the app, challenge notification	Physical: Phone, Cashier Digital: Check out/payment option setting on the app	Physical: Phone Digital: Profile page; badge notifications
opportunities	Provide SCT information based on the users preferences	Reinforce positive choices by showing the sustainability impacts.	Congratulate her and send a notification of her success.	Ensure an easy payment process without re-scanning all products. Provide clear instructions for redeeming or accumulating points.	Celebrate her achievement with rewards and the option to share the completed challenge on her profile.

Figure 41 - Line's User journey Map

After the groceries shopping

steps	Reviewing Sustainability Impact Summary	Scrolling trough the Community space page on the app	Sharing her accomplishments	Receiving montly sustainable report
time	Shortly after returning home (1 minute)	(5 minutes)	After reviewing her impact and seeing the other users sharings (2 minutes)	At the end of the month (2 minutes)
actions	Reviews her sustainability impact report, seeing the overall environmental impact from her purchases.	Scrolls through the community space to see what other users are sharing, like badges and environmental reports.	Shares her first sustainability badge for completing a challenge.	Receives a monthly sustainability progress report showing her environmental impact.
feelings	😊 Proud of her impact and motivated to do more.	😊 Inspired by others and motivated to continue contributing.	😊 Integrated in the community	Informed and motivated to improve next month.
touchpoints	Physical: Home, phone Digital: Sustainability summary page in the app	Physical: Phone Digital: Community space page on the app	Physical: Phone Digital: Profile and community page on the app	Physical: Phone Digital: Sustainability summary page on the app
opportunities	Reinforce her positive feelings with visual summaries and badges achived.	Encourage engagement and foster a sense of community for collective progress.	Foster a sense of belonging and motivate others to share their achievements.	Offer status upgrades based on the users performance.

Figure 41 - Line's User journey Map

Magnus

During the groceries shopping

steps	Updating the app	Understanding the app changes	Awareness of the Community space feature	Settings	Scanning products
time	One day before going to the supermarket (4 minutes)	Immediately after upgrading the app (2 minutes)	(5 minutes)	(1 minute)	(few secounds) per product
actions	Magnus receives a notification to update the app due to new features.	He explores the app, noticing the intuitive design and improved UX/ UI.	In the community space, he sees options to share accomplishments and join challenges but he is not interested in either for now.	He doesn't want to have his profile visible so he goes to the settings page and turns off the visibility of his profile.	At the supermarket, he scans products to check the new information.
feelings	🤔 Sceptical because he liked already the app as it was	🤔 Curious about the new information the app provides (SCT)	😐 indifferent	😐 indifferent	🤔 Intrigued
touchpoints	Physical: Phone, home Digital: App store	Physical: Phone and home Digital: Home page	Physical: Phone and home Digital: Community space page on the app	Physical: Phone and home Digital: Settings page	Physical: Phone, supermarket and product packaging Digital:Scanning feature on the app
opportunities	Highlight new sustainability features in update notifications to generate excitement, while reassuring that the main functions remain unchanged.	Walkthrough demo to showcase the changes and new features.	Gently remind users of participation benefits, encouraging them to join challenges when ready.	Possibility to change the settings at any time	Provide clear, easy-to-understand sustainability data. Allow easy comparison between products in terms of sustainability

Figure 42 - Magnus User journey Map

Magnus

	During the groceries shopping				After the groceries shopping
steps	Observing info in the app	Adding products to the digital cart	Ecologic footprint notifications while adding products	Payment	Feedback notification
time	(1 minute) per product	(2 minutes)	(1 minute)	(1 minute)	(few seconds)
actions	He can see the additional details about products and it's SCT values and the sustainable guidelines.	He finds that a product he used to buy is not sustainable, so he switches to another brand, understanding that sustainable choices earn more points.	He sees the eco footprint saved by adding sustainable products to the cart.	At checkout, he uses a QR code to pay and decides to use his accumulated points.	He sees a pop-up notification asking to rate the experience.
feelings	😁 Surprised about the amont of information he finds	😁 Motivated to buy sustainably to earn points and find more sustainable brands.	😁 Enthusiastic	😐 Neutral since he was already used to this payment method	😁 Satisfied and impressed with how intuitive and smooth the app is
touchpoints	Physical: Phone and supermarket Digital: Scanning feature and digital shopping cart	Physical: Phone and supermarket Digital: Digital cart in the app	Physical: Phone and supermarket Digital: Digital cart, and sustainable impact summary	Physical: Phone and supermarket Digital: Check out/payment option on the app	Physical: Phone and supermarket Digital: Pop up notification
opportunities	Showcase the sustainability guideline with easy to understand visuals	Use point accumulation as a way to motivate users to buy sustainable. Allow them to see the points they are gathering while choosing products	show eco-impact in a visual way	Keep the payment process quick and easy, with clear instructions for redeeming points or accumulating them.	Simplify feedback collection with one-click options (5 stars rating e.g)

Figure 42 - Magnus User journey Map

Magnus

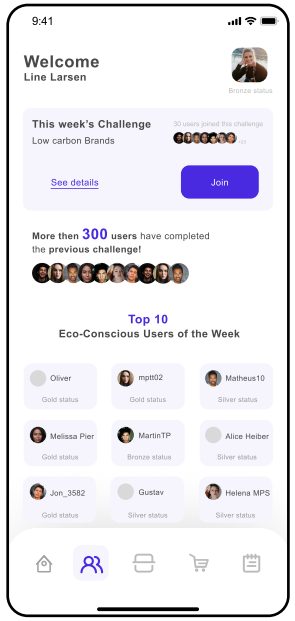
After the groceries shopping

steps	Sustainable summary report
time	(1 minute)
actions	He checks his sustainability report, reviewing the impact and points accumulated.
feelings	😊 Inspired to keep buying more sustainably
touchpoints	Physical: Phone and supermarket Digital: Sustainability report on the app
opportunities	Provide a visually appealing summary of his environmental impact and point earnings, emphasising the positive change.

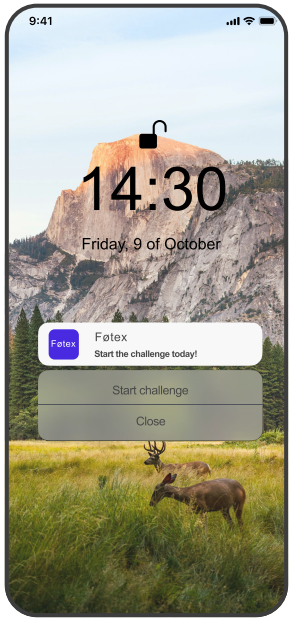
Figure 42 - Magnus User journey Map

8.6 Storyboard

A storyboard is a visual tool used to outline and illustrate a narrative trough a series of images in a structured sequence. This method helps to illustrate the flow of a story or process, making it easier to understand the progression of events or interactions step by step (Stickdorn et al., 2018).
It has been observed that both low- and high-fidelity prototypes are equally effective in identifying usability issues, regardless of whether paper or digital tools are employed (Walker et al., 2002). This flexibility allows designers to select the fidelity level that align with their practical needs and design goals. In this project, initial interface ideas were sketched on paper (Appendix 5), and these were later refined into high-fidelity wireframes on the computer. Iterating on the sketches in this way was beneficial, especially for the usability testing phase, where a more detailed prototype was considered beneficial.
In this storyboard (Figure 43), a specific phase of the user journey was highlighted, focusing on the moment when the user (Line) joins a challenge and continues through the process until completing the payment. This approach was designed to help visualise how these steps would function and appear on the mobile app, offering a clear representation of the user's interaction throughout the challenge.



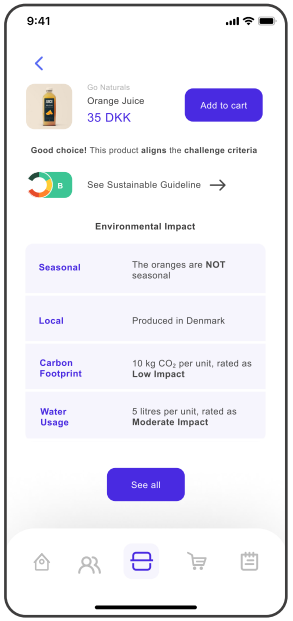
Line enters the community space and decides to join the challenge



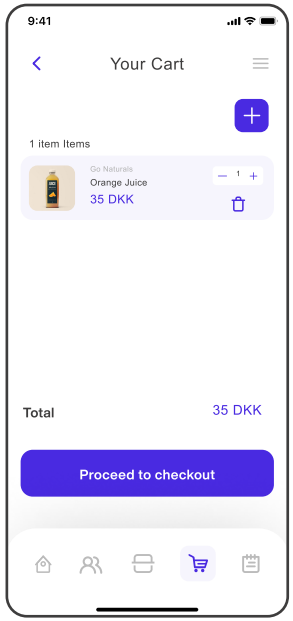
The next afternoon she receives a notification reminding her about the challenge and decides to start the challenge

The app directs her to the scanning page and she chooses the first product to scan

She scans the product and clicks on “See Environmental Info”



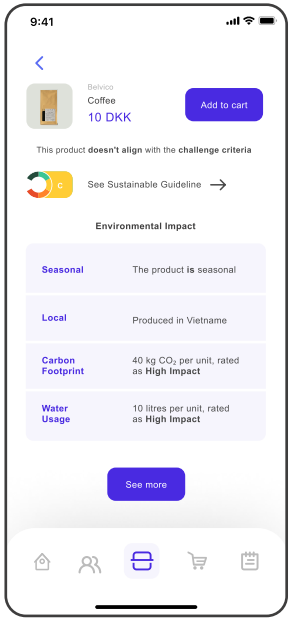
She reads about the SCT info about that product and notices that that item aligns with the challenge criteria so she decides to add it to “Add to Cart”



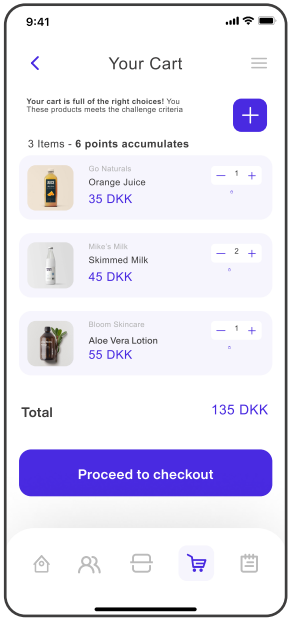
Then she decided that she wants to add more products and press the button to add more (+)

Figure 43 - Storyboard

She scans another product she wants to buy

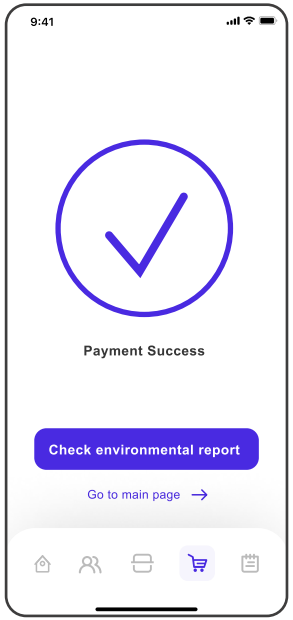


Then she is not satisfied with the eco-impact of that product and see's it doesn't align with the challenge criteria so she doesn't add it to the cart

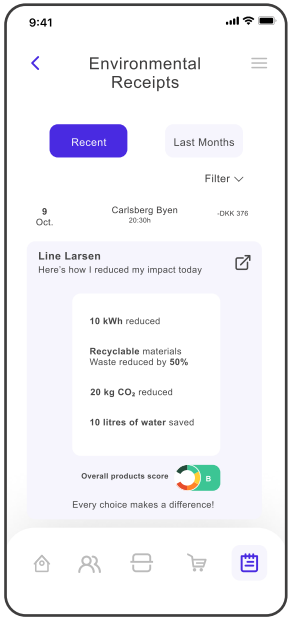


Line continues her shopping but paying attention to the SCT info and challenges criteria and decides to proceed to checkout after checking the accumulated points

The QR Code is generated and she is able to easily pay for the groceries



The payment is completed and she decides to check her overall environmental impact



She sees the receipt and decides not to share it this time

Figure 43 - Storyboard

8.7 Service Architecture Map

The system map (Figure 44) serves to illustrate and highlight the structure of the service, clearly showing how actors are linked together. It provides a visual representation of the material, information, and financial exchanges within the system (Manzini et al., 2004). Furthermore, the map defines the boundaries of the service system, specifically focusing on the app, which helps clarify what is designed and prioritised.
This tool was applied to explore the service system at a higher level, illustrating the exchange of flows between each actor within the system.

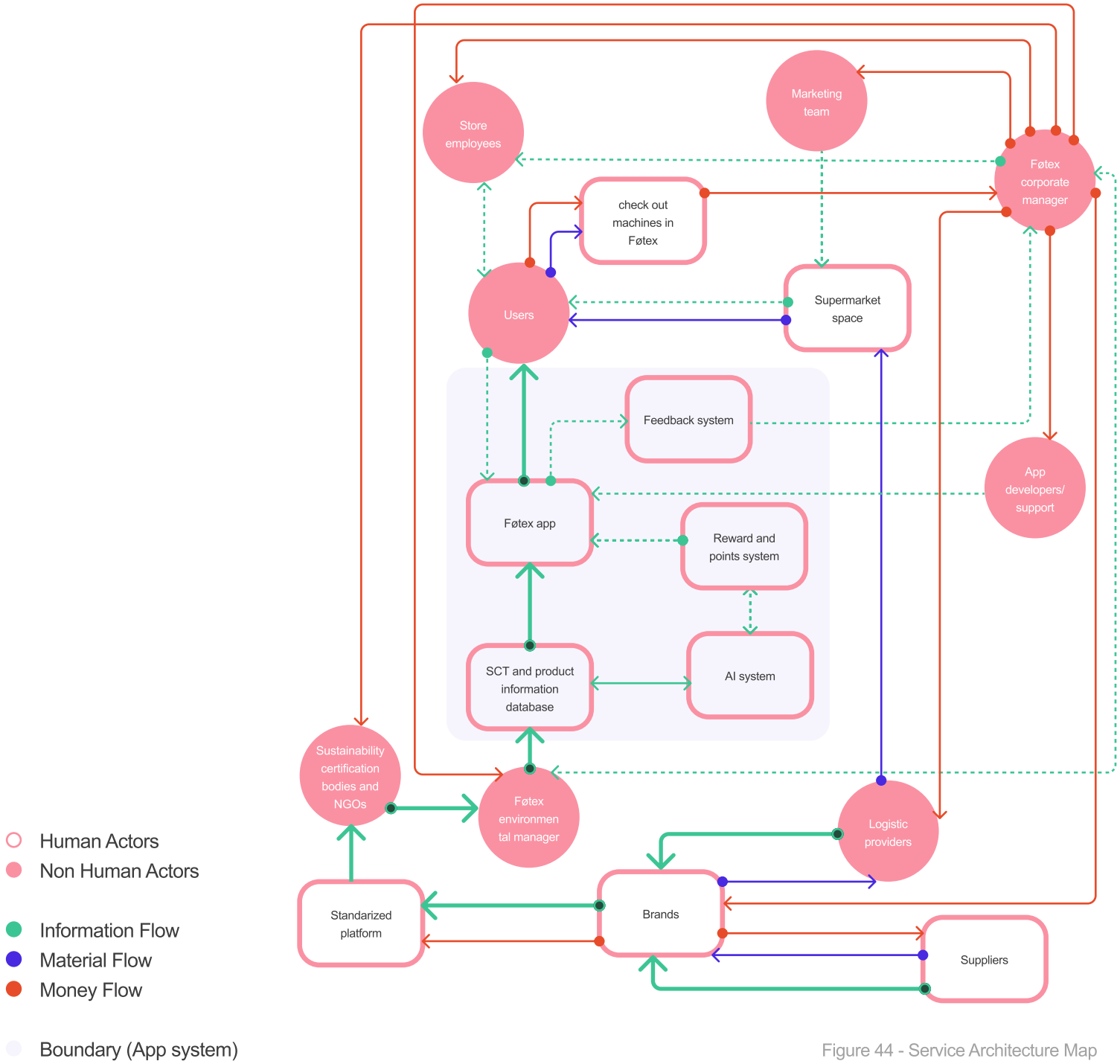


Figure 44 - Service Architecture Map

In this architecture map, the green lines represent the information flow, focusing specifically on the SCT information exchanged between the various actors. The information flow demonstrates how sustainability data and other details are transmitted to the users.

7.10.1 Information Flow

The thicker green lines emphasise the flow of SCT information, starting with the suppliers who provide raw material information to the brands. After the goods have been produced, they are sent through logistic providers, who return transportation-related information back to the brands. The information gathered from both the suppliers and logistic providers is then combined by the brands, who submit this consolidated data to a standardised platform (such as Sedex). On this platform, all sustainability and product-related data, including environmental impact and sourcing information, is captured in a consistent format.
Once submitted, the information is accessed by NGOs and certification bodies, who validate the data to ensure compliance with sustainability standards. After certification, the information is forwarded to the Føtex Environmental Manager. The environmental manager evaluates and rates the products based on their sustainability levels, in accordance with the Føtex's sustainability guideline. Once the evaluation is completed, the SCT information is uploaded to the Føtex database, where it is stored as part of a central repository for all validated sustainability-related information. From the database, the information is transferred to the Føtex app, where it can be accessed by users, ensuring transparency and enabling informed decision-making.

The thinner green dashed lines showcase that the Føtex manager is responsible for ensuring that the store employees are well-informed about the app features and SCT values, such as sustainability guidelines, and this allows the employees to assist users with any questions regarding the app or product sustainability metrics. By being equipped with this knowledge, store employees are able to guide users effectively through both the app's functionality and the sustainability information related to the products.This two-way exchange of information between users and employees helps improve customer service and ensures a good user experience.
Although not giving directly SCT information to the users, the marketing team plays an important role in raising awareness about the app and its new features. Posters and other promotional materials are created to highlight the app's benefits, driving user engagement. These materials are placed in the supermarket, ensuring that users are informed about the app, to ensure that both the app's features and its connection to sustainability guidelines are communicated clearly.
Additionally, the Environmental manager and the Føtex manager exchange information with each other to make informed decisions about which products will be stocked. By accessing verified sustainability data, the corporate manager ensures that the products on the shelves align with Føtex's sustainability guidelines and meet user expectations. This flow of information strengthens the decision-making process regarding product selection and sustainability practices.
In summary, the flow of information between managers, store employees, and marketing team creates a consistent system where users, employees, and managers are aligned around the app's features and sustainability goals.
The feedback system collects user information based on their experience satisfaction and is then sent to the corporate manager who can review it for further improvements, whether this involves fixing app functionality, adjusting how sustainability information is presented, or making other changes.
App developers do not provide SCT information but they are responsible for maintaining and improving the app's technical infrastructure. This includes implementing new tools or user interface improvements, which are reflected on the way this SCT information in presented to the users on the app.
The reward system interacts directly with the app. Users accumulate points or rewards based on their purchases (such as buying sustainable products), and this data flows from the reward system to the app, allowing users to view their points or rewards. Information regarding rewards, such as points earned or redeemed, is exchanged between the reward system and the app.
The SCT database sends sustainability information, such as sustainability scores or certifications, to the AI system. This data is required

for the AI system to determine which products qualify for rewards based on their sustainability criteria.
The Reward and AI system would exchange information with each other by the reward system sending data to the AI to keep it updated on user progress, reward redemption, or point accumulation, and the AI system would analyse user behaviour, sustainability choices, and interactions with the app to generate or adjust rewards.

Material Flow

The material flow begins with the suppliers, where raw materials are sent to the brands for production and packaging. Once ready, the products are given to the logistics providers, who handle the transportation and distribution of these products to the supermarkets. There the products are stocked and made available for purchase. The users, can see the products in store and select them proceeding to the checkout machines, where the payment is processed and the products are taken by the users, completing the material flow from supplier to user.

Money Flow

The majority of the money flows from the corporate manager, who coordinates and funds several critical components of the service. This includes paying for the app developers who design and maintain the digital infrastructure, to the marketing team, responsible for promoting the app and its sustainability features to users, to the store employees, who interact with users and manage in-store operations, to certification bodies or NGOs, which play a crucial role in validating the sustainability data and ensuring transparency. The Føtex can partner with these organisations or NGOs contributing to their funding, ensuring they can certify products according to sustainability standards.
Additionally, the environmental manager, who is responsible for supervising sustainability data and putting verified data into the SCT database, is also paid by the corporate manager.
Finally, the corporate manager also pays for logistics providers, who ensure that products are transported efficiently from brands to the supermarket.
On the other hand, brands have their own financial responsibilities. They pay suppliers for the raw materials required to produce goods, and they also pay for access to standardised platforms that provide certification and transparency services, enabling them to verify their sustainability claims and make the information available (this methodology works already in platforms mentioned in previous research such as Provenance, where the brands pay for having their supply chain data verified.
Finally users send money flow by paying at checkout machines when purchasing products. This money then goes from these transactions flows to the corporate manager.

The Service boundary

The boundary refers to app system and includes the app itself for being the interface the users interact with and that provides access to SCT data and rewards. Through the app, users can explore sustainability scores, and earn points for eco-friendly choices.
This app acts as the main access for users to engage with the system, incorporating the features and detailed product information.
The feedback system that is incorporated within the app and collects and processes feedback that can be related with how the SCT information is displayed on the app also belongs inside the boundary.
The reward and points system, that is the gamified element of the app that incentivises users to make sustainable purchasing decisions.
The SCT database that is one of the most critical components within the boundary because it stores all verified data regarding the sustainability of products. The database also integrates with external certification bodies and NGOs, ensuring that the data is accurate and up to date.
The AI system processes data from the SCT database, scoring products based on sustainability criteria. It also personalises the app for each user, making it an integral component of the app and placing it within the system's boundaries.

Reflection on the Architecture Map

The reflections on integrating sustainability data across supply chains highlight several challenges and complexities. One of the major technical difficulties involves integrating data from multiple brands, which can become highly complex (Najjar et al., 2022). This process often relies heavily on the accuracy and transparency of suppliers and logistics providers. If earlier in the process partners are not rigorous in tracking their sustainability metrics, incomplete or inaccurate data might be uploaded to standardised platforms like Sedex (Sedex, n.d) or IBM Food Trust (IBM, n.d.), which could compromise the accuracy and reliability of the information being shared.

Another consideration is that some less sustainable brands may hesitate to provide full data to platforms like Sedex, fearing exposure of their unsustainable practices. If this occurs, brands could be rated poorly based on the penalties from the sustainability guideline (Chapter 7.7) for failing to provide sufficient information in accordance with Fotex's sustainability guidelines. This poor rating could lead to consumers choosing not to purchase these products, which, over time, might force brands to improve their sustainability practices to regain consumer trust and increase sales. Further constraints include the time and cost required for brands to upload their data to standardise platforms. This could create additional burdens for brands, especially smaller ones, when deciding whether to share their sustainability data.

In the event that a non-sustainable brand refuses to share its data, supermarkets might still stock the product initially because there is still consumer demand and profit potential. However, as consumers become more aware of sustainability issues and gradually stop purchasing these products, supermarkets may reconsider their decision to stock such brands, especially if they are no longer profitable. Alternatively, the brand could choose to improve its sustainability practices, leading to renewed consumer interest and increased sales.

Determining who should partner with certified bodies or NGOs for certification purposes has been a challenging decision in this project. It ended being decided that brands will individually submit their data to standardised platforms, such as Sedex or IBM Food Trust. Meanwhile, the Føtex manager will take on the responsibility of funding NGOs or paying for certified bodies to verify the data. This approach eases the burden on brands while still ensuring that the sustainability information is accurately assessed by trusted third parties, and the Føtex also benefits from it.

As another reflection, collaborations on sustainability initiatives offer the potential for improvements by working together, crucial product information and can be shared, benefiting both sustainability efforts and logistics management (Waller et al., 2015).

Although this standardised platforms and partnerships with certified bodies and NGOs help mitigate the risk, the potential for human error or lack of rigour in data collection and reporting remains a challenge in ensuring full transparency and accuracy throughout the supply chain.

These limitations emphasise the challenge of accurately representing sustainability data from different sources (Sarfaty, 2020).

If brands are not fully committed to transparency, or if they attempt to minimise sustainability weaknesses, certification bodies may face significant challenges in verifying the essential data.

The service architecture map has been through multiple iterations to reach its current version. Initially, a simple structure was developed, followed by further research to validate the connections and flows within the system. After each round of research, the map was revised and refined, leading to gradual improvement. This iterative process involved constant adjustments with each version deepening the understanding of the system’s components and their interactions.

By carefully reviewing the role of each actor and refining the flows of information, money, and materials, this map now represents all elements properly connected and justified in terms of their function within the system, particularly regarding the flow of SCT information.

8.8 Service Blueprint

The Service Blueprint is a tool used to map out the entire process of a service delivery, illustrating the actions, actors, and touchpoints involved (Design Council, n.d.), both those visible to users (frontstage) and those behind the scenes (backstage) (Bitner et al., 2007). This method allows for clearer communication of a service proposal, while representing the necessary features and connections, both human and non-human, required for its implementation.

The blueprint was structured by listing the actors involved on a vertical axis and the steps required to deliver the service on a horizontal axis. The flow of actions for each role is then represented, highlighting the visible actions (above the line of visibility) and the backstage actions that occur behind the scenes (below the line of visibility) (Service Design Tools, n.d.). This visual representation allows the entire service to be captured in a single diagram (Figure 45).

In addition to mapping the user's journey, the Service Blueprint includes the backstage elements, that include that are necessary for the frontstage actions to function smoothly (Design Council, n.d.; Stickdorn et al., 2018).

Through the use of a Service Blueprint, the interactions between the frontstage and backstage of a service can be understood and optimised, ensuring the effective delivery of the service as a whole.

The Service Blueprint focuses on the app system, which defines the boundary within the Architecture Map (Chapter 8.5), as it is the central point where users interact with the service.

This blueprint highlights the app's crucial role in shaping the user experience, facilitating interactions, and ensuring smooth access to the system's functionalities.

In the app is where users will receive the SCT information, and engage with the features. The app is designed to facilitate the delivery of the solution's core goals, ensuring that users can access the necessary information and features effortlessly.

Pre-Conditions

The preconditions in a Service Blueprint are the necessary elements and conditions that must be in place for the service to function smoothly. They support the integration of product and service innovation (Dewit et al., 2021). These preconditions ensure that all necessary elements are in place to support both frontstage and backstage processes, ultimately enabling smooth service delivery and enhancing the overall user experience. (Dewit et al., 2021)

It is ensured that all required tasks are prepared and aligned before the service is delivered to the users. In this case, the app developers, the AI system, and SCT database are included to ensure that the information and interface are ready to be used.

App Developers:

Onboarding Experience and User Interaction

- The onboarding experience must be designed, ensuring that welcome screens load easily.
- Updating the app's code and interface to ensure that the privacy policy must comply with with privacy regulations
- Buttons across the app must function correctly to provide a smooth user experience.
- Develop the interactive demo to showcase new features

Functionality and Navigation

- The notification system must be configured properly, and clicking on notifications should direct users to the correct app section.
- The camera functionality must be integrated with barcode scanning technology, ensuring efficient accessing of data from the database.
- Users should be able to add products to the cart, with the app allowing multiple items to be added, and the cart to be edited at anytime.
- The cart within the app must accurately reflect data about the products, ensuring the interface accurately pulls and shows real-time information.
- When a product is removed, the challenge completion status must be recalculated.

Checkout Process and Rewards Integration

- The checkout process must be simple and user-friendly.
- The functionality to apply discounts should be implemented, and the points deduction system must communicate correctly with the payment system.
- The interface should display a clear breakdown of points applied and the final price to the user.

QR Code and Payment Systems

- The QR code generation system must be functional and secure.
- It must be ensured that the payment transaction is reflected correctly in the app.

Sustainability and Reporting

- The app must display the eco-impact report using data from the sustainability database, showing the final environmental impact of the purchase.
- The sharing functionality for eco-impact and reports should be easily skipped or postponed by users.
- This information should be stored in the user's profile for later reference.
- Monthly reports from the product information and sustainability database must be displayed correctly, with an option to share them in the community while respecting privacy settings.

Feedback and Achievements

- The feedback interface must be set up and made accessible for the app manager to review.
- Achievements should be stored in the user's profile, with the option to share later. These achievements should be visible on the user's profile page

General Performance and Security

- Security measures must be ensured for data storage, payment processing, and the privacy of users' profiles.

AI System

Community Space

- The system must ensure that updates related to challenges, sustainable badges, and sustainability status are generated based on each user's performance

Challenges and Status Updates

- The system must generate weekly challenges based on sustainability goals.
- Generate detailed information regarding these weekly challenges, such as instructions and guidelines.
- The AI system must continuously update the status of challenges, ensuring that users can track their progress and see the completion of sustainability challenges.

Badges and Rewards Integration

- The system needs to update user's sustainable badges and track their achievements based on completed challenges and actions.

Sustainability Data Management

- It must ensure that environmental impact data from user's activities is accurately recorded and linked to their sustainability achievements.

SCT Information

- It gives a score based on the sustainability guideline criteria to each product

SCT Data in the App

- The product data and sustainability criteria are stored in the database.

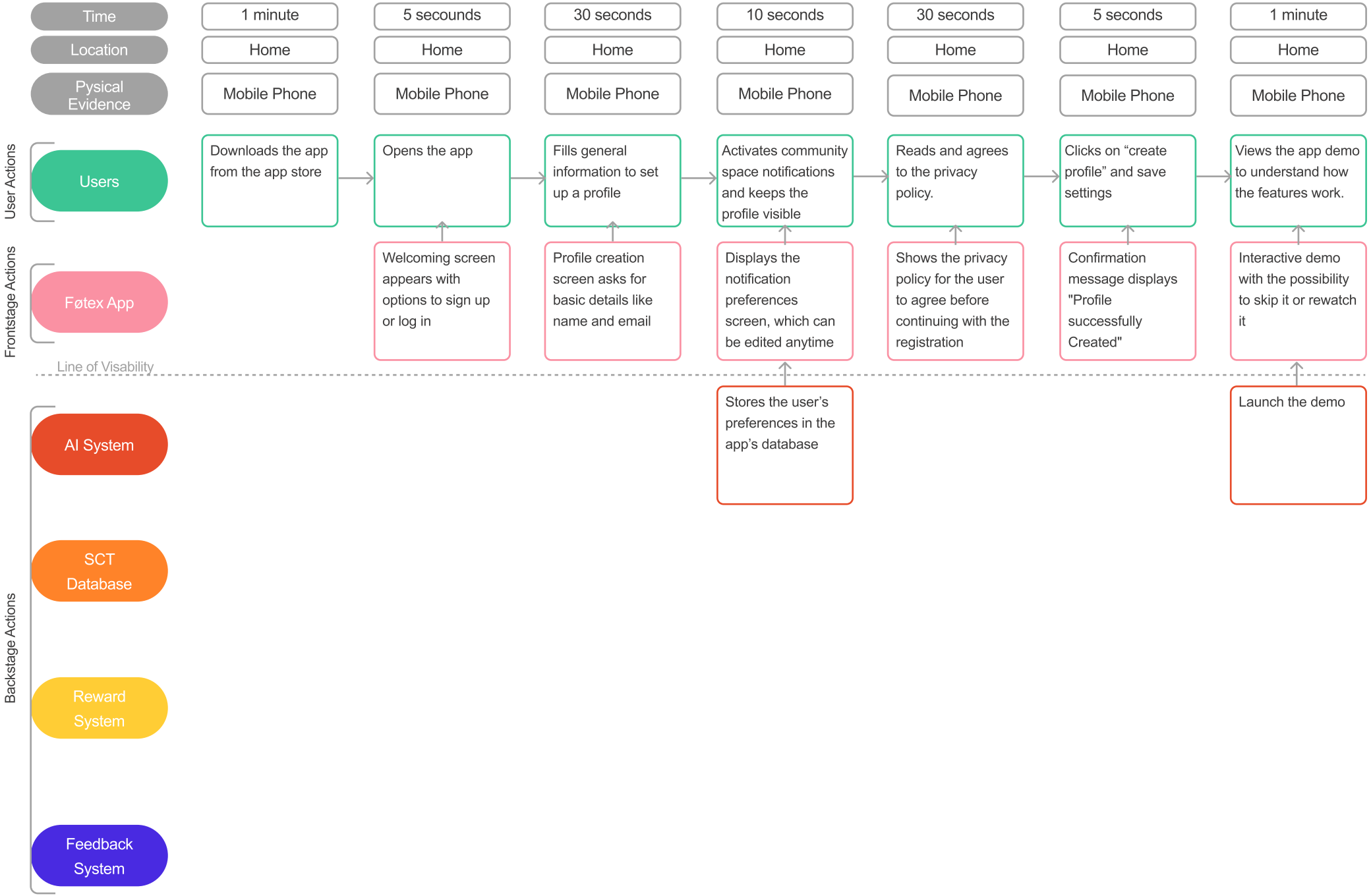


Figure 45 - Service Blueprint

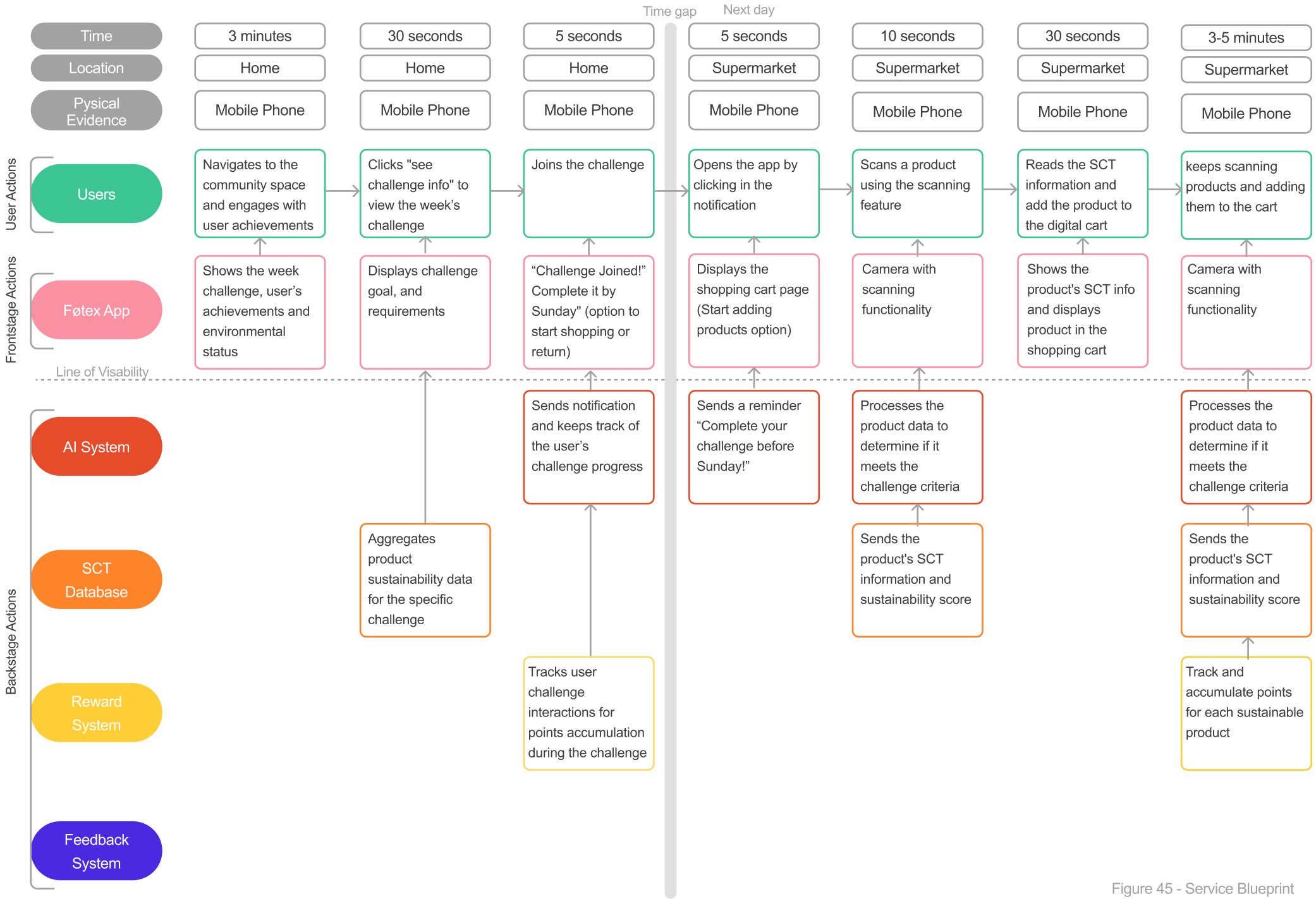


Figure 45 - Service Blueprint

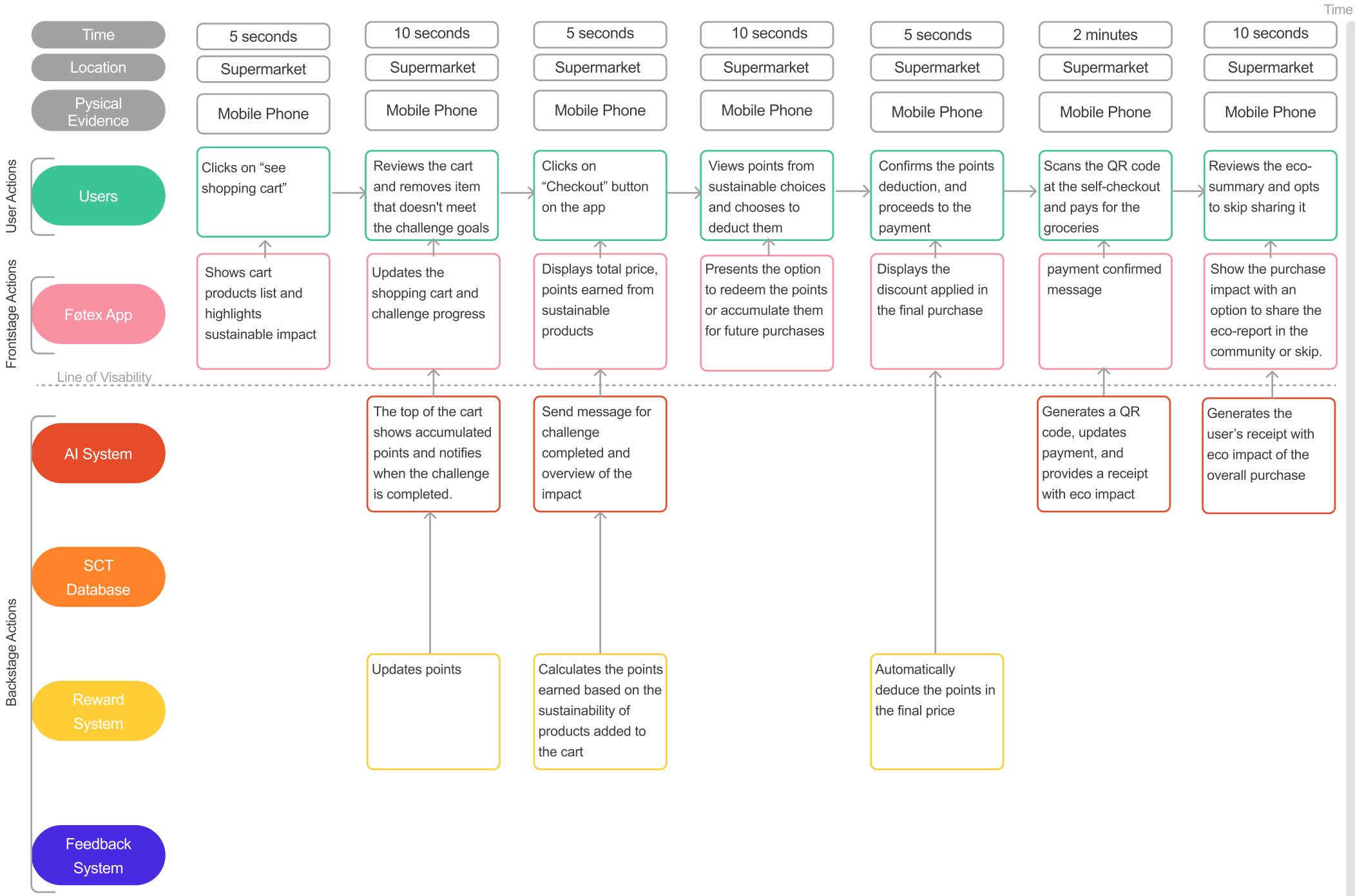


Figure 45 - Service Blueprint

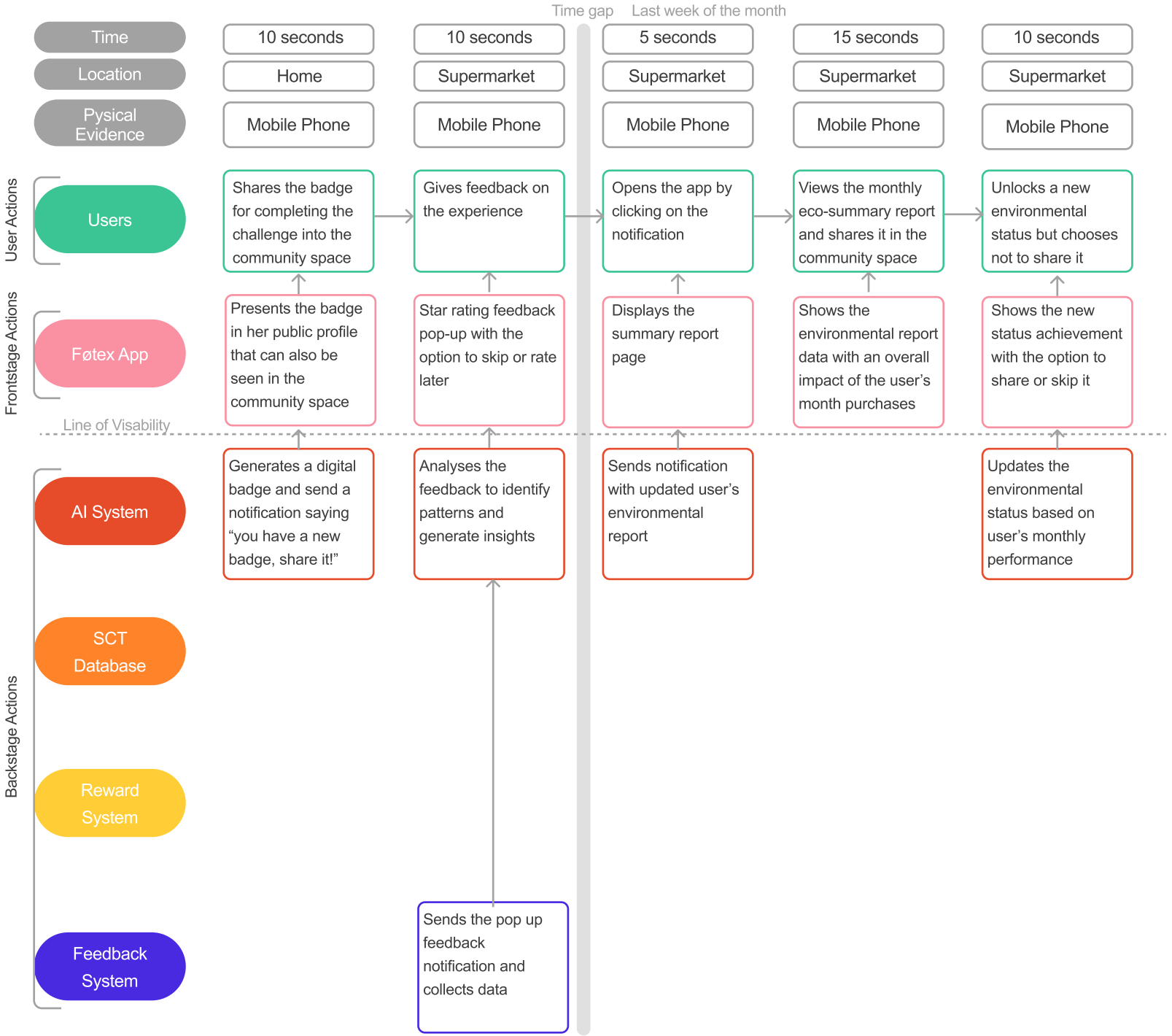


Figure 45 - Service Blueprint

CHAPTER 9

Upcoming Developments

9.1 Usability Testing and Iterative Improvement

For this study, individual in-person and online testing sessions will be conducted to identify usability issues. Usability testing refers to the process of evaluating how simple and effective a design is by observing representative users as they try to perform specific tasks, this testing will allow the proposed solution to be evaluated and examined in order to identify any potential usability pain points or areas for improvement. (Interaction Design Foundation, 2024) After the testing sessions, an analysis of the results will be carried out to inform further iterations of the solution and improvements based on the findings.
Prototyped wireframes (Figure 46) have been prepared to represent each feature and component required on each page of the proposed app. The prototype has been made interactive to ensure that important tasks, such as clicking buttons, navigating between pages, and going back to previous screens, can be performed by the participants effectively.

The time taken by users to complete specific tasks will also be recorded, as this can indicate how intuitive and user-friendly the app is. By analysing these time measurements, insights can be gained into areas where the app may require further optimisation or improvements in usability.
The testing plan involves providing each participant with one use case (Chapter 9.1.1) and asking them to navigate through these scenarios using the think-aloud method. This approach will help in understanding any confusion or frustration participants may experience during the process.
Following the task conclusion, participants will be asked some feedback questions to evaluate their overall experience and gather insights on what can be improved to enhance their satisfaction with the service.

Usability Testing Scenario (Full User Journey)

This scenario tests the user's ability to activate notifications and the visibility of their profile, select sustainability preferences, join a community challenge, scan products "at a supermarket", and finalise the shopping. It also evaluates how users

interact with the sustainability reports and sharing features. The goal is to understand how intuitively users can navigate the app's different functionalities.

Before starting the activities, an introduction about the overall goals of the project and explanation on the activities will be provided to the participants to ensure they fully understand the purpose and goals of the service proposal. This initial guidance will help participants feel comfortable and confident as they navigate the tasks, ensuring more accurate feedback and observations during the usability testing.

Test Scenario: "Eco-Friendly Shopping Journey"

Task 1: Activate Profile and Notifications

Goal: Test if the user can locate the profile and turn on notifications.

Instructions: "Start by going to the app's settings, and on the profile page activate the community notifications."

Task 2: Select Sustainability Preferences

Goal: Test how users select the SCT factors they consider most important. This chosen factors are the ones that will appear first on the screen when scanning a product.

Instructions: "Now I want you to customise your sustainability preferences. Please choose the factors you consider most important (e.g., CO_2 emissions, water usage).

Task 3: Join a Challenge on the Community Page

Goal: Evaluate how easily users can navigate to the community page and join an ongoing sustainability challenge.

Instructions: "Now please go to the community page and join the week's challenge"

Task 4: Scan and Add Products to the Cart

Goal: Test if users can easily scan products and add them to the cart.

Instructions: "Imagine you're at the supermarket. Go to the scanner feature and then go to the shopping cart"

Task 5: Finalise Shopping

Goal: Ensure users understand how to do the checkout process to finalise the shopping.

Instructions: "Now you have to complete the purchase. Check if the items have the challenge criteria to complete the challenge."

Task 6: Review and Share Sustainability Reports

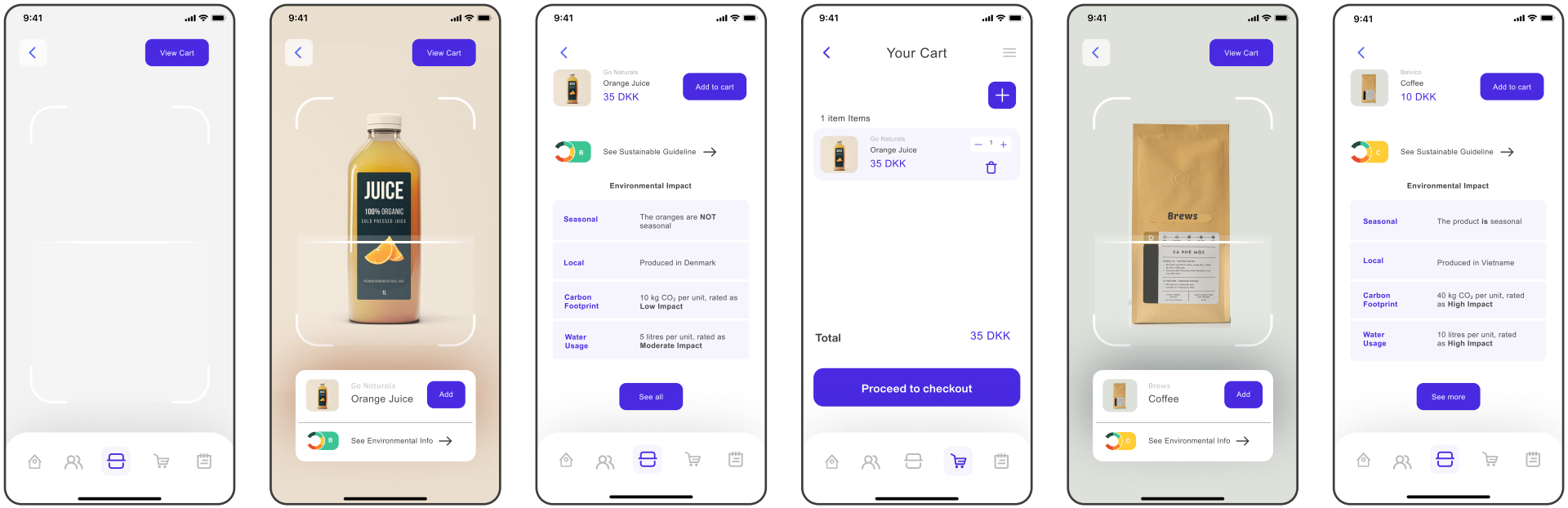
Goal: Evaluate if users can easily find their sustainability report and share it.

Instructions: "Now, review your sustainability report for this purchase. Once you've reviewed it, share the report to the community space."

Follow up questions (Open discussion)

The intention with these open discussion after the users have completed the tasks is to gather overall feedback on the user journey and the app's usability.
This input will provide insights into the clarity and influence of the information on user's buying behaviours.
Participants will be asked to share their overall experience of navigating the app to gather insights into what aspects of the app worked well and identify any areas that can be improved to enhance user satisfaction and usability. Another important aspect is to determine if participants find the presentation of SCT information clear and easy to understand. Additionally, they will be asked if they believe this solution could encourage or motivate them to make more sustainable choices. This will provide insights into how effective the app is in guiding users towards eco-friendly behaviours and whether the way information is delivered plays a role in influencing their decisions.

Scanning Feature and Shopping Cart



Community space Page

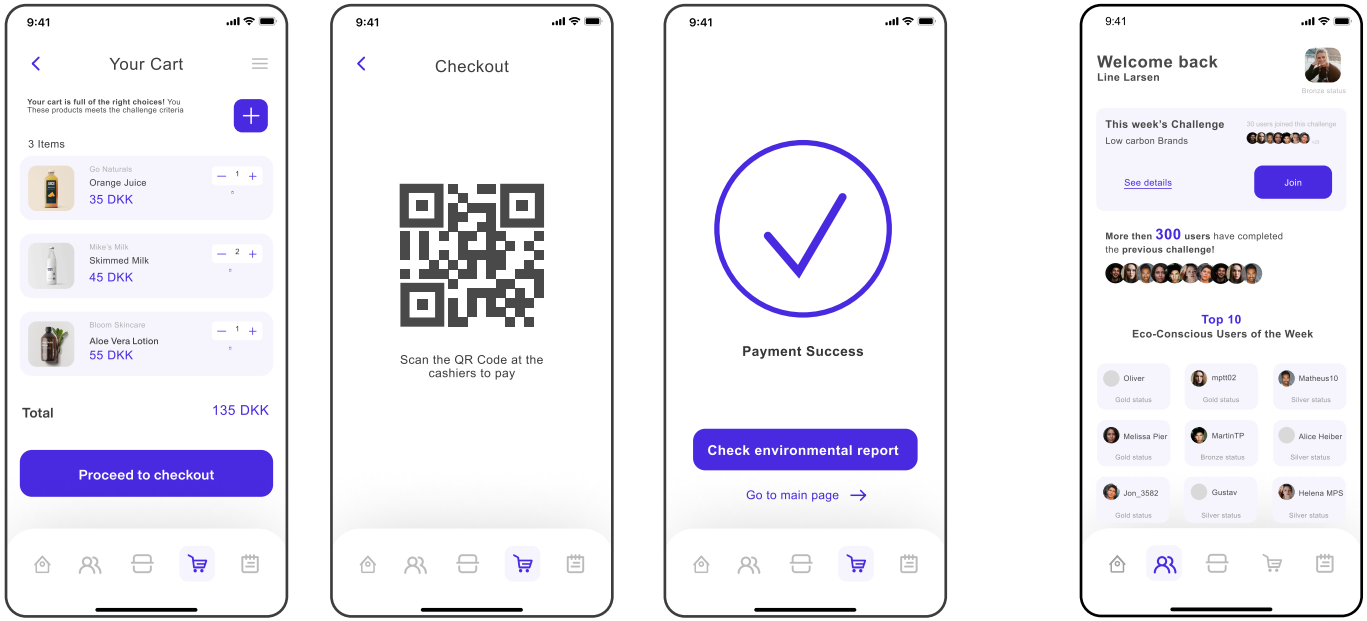
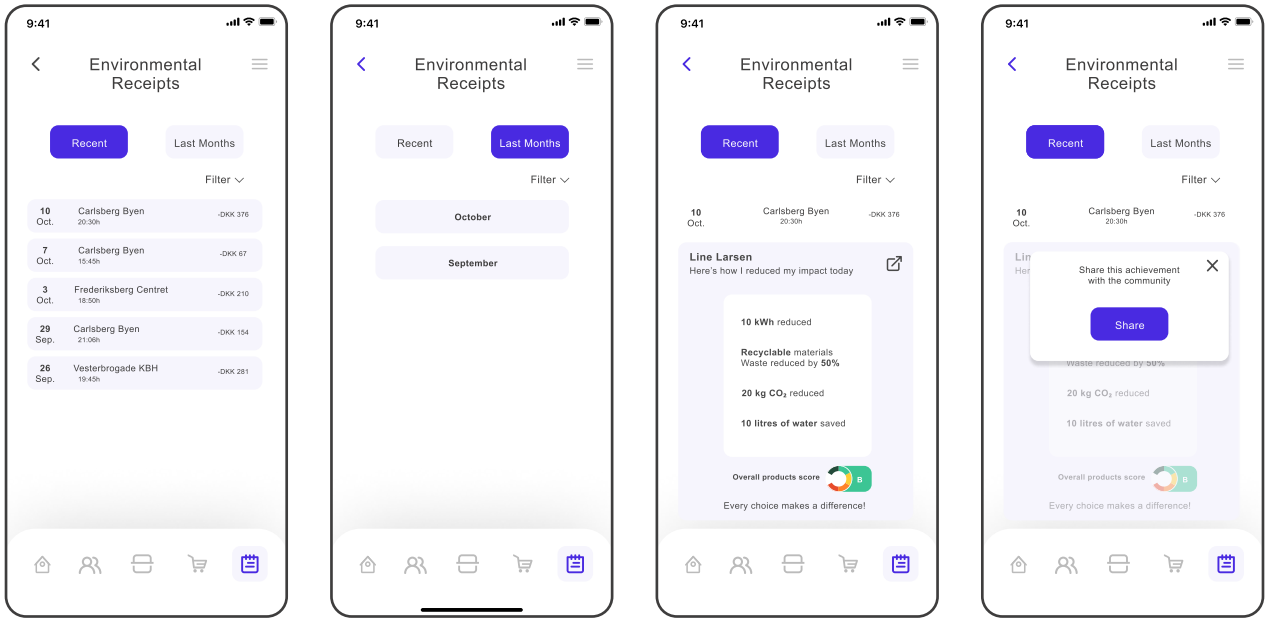
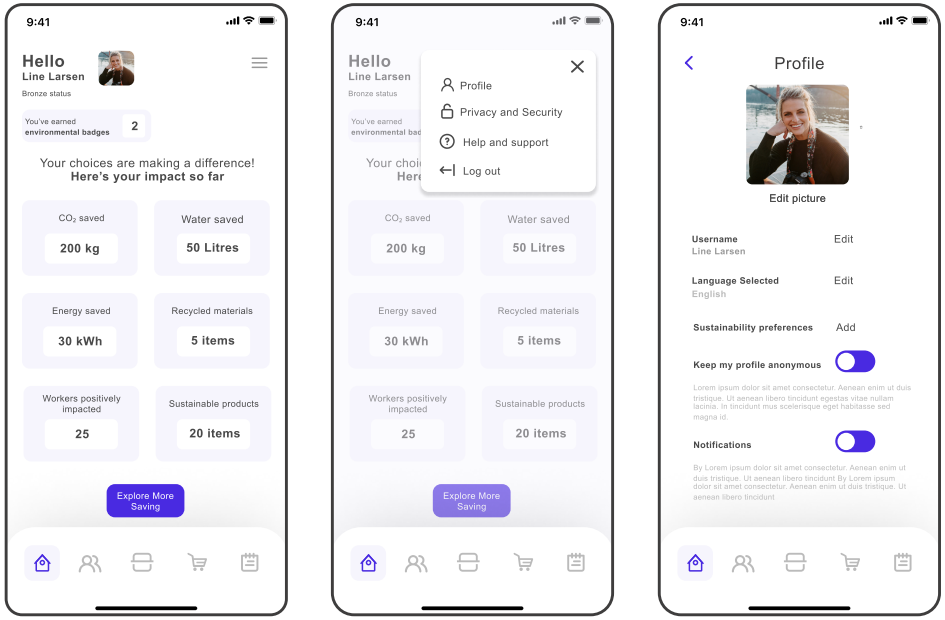


Figure 46 - Prototype Wireframes

Environmental Report



Home page, Settings and Profile



Notifications

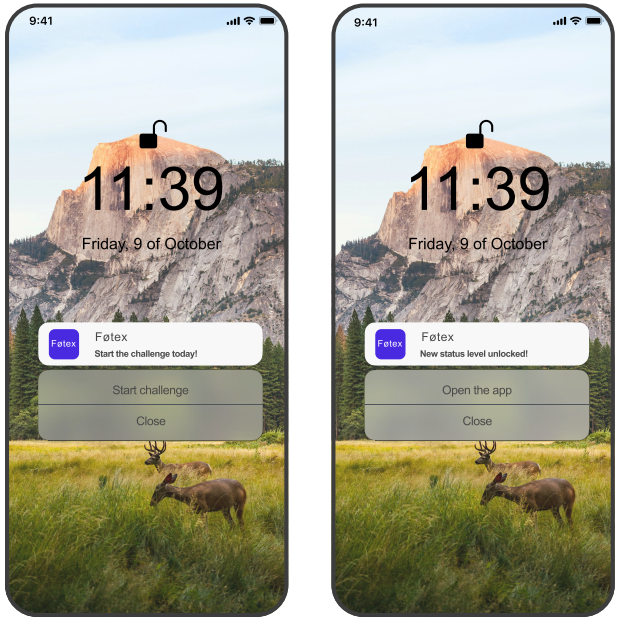


Figure 46 - Prototype Wireframes

CHAPTER 10

Discussion and reflections

This thesis highlights the importance of integrating sustainability into service design by creating a solution that not only promotes environmental goals but also meets user needs. The solution developed in this project offers several advantages, such as improved supply chain transparency and enhanced decision-making for users who wish to make sustainable choices. By leveraging AI and standardised platforms, the system can process large amounts of data, making personalised information available to users. This not only improves the user experience but also encourages sustainable consumption by providing real-time insights into the environmental impact of products. Furthermore, the solution promotes awareness across the supply chain, encouraging brands to adopt more sustainable practices.

The project focused on human-centered design, emphasising the creation of a service that is inclusive and accessible, ultimately enhancing the societal impact. Human-centered design prioritises inclusivity by addressing the needs of diverse users, considering their varied capabilities and expectations. Inclusive service design, in particular, plays a crucial role in ensuring the services adresses to all users, promoting broader social equity and accessibility (Aceves-González et al., 2022).
The re-design of the Føtex app intends to place the users at the center of its development. The possibility of personalising the app based on user interests about the SCT data and the sustainability tracking are designed to directly respond to user preferences and behaviours. Also the feedback mechanism ensures that the system adapts based on user's satisfaction, making it more intuitive and relevant.

One of the main reflections from this project was the limited access to stakeholders, which limited the opportunity to gain a broader understanding of how the service could work in real life. Engaging a wider variety of stakeholders, such as not so sustainable brands and NGOs, could have offered deeper insights and opportunities to analyse how the service would function and could have created a stronger foundation for the practical implementation of the service. This would have allowed for a more comprehensive understanding of diverse perspectives and needs, ensuring

that the solution was better tailored for real-world application. While the limitation of some stakeholders was reduced through the use of secondary sources such as literature and desk research more direct involvement with different stakeholders would have enriched the project.
Another reflection is that would have been better to have a more iterative design based on not only stakeholders insights but also possible user's of the app based on their feedback and not just by research. If I had incorporated it in multiple stages it would be possible to refine it and ensure that the proposed services could improve based on the responses of the user needs.

Achieving sustainable living demands a combination of technological innovation and human involvement. While advancements in eco-friendly technologies are indispensable, they are not sufficient on their own to address global sustainability challenges (Santana et al., 2015). Human factors, such as changes in behaviour and social innovation, are equally important in promoting sustainable practices. For instance, feedback mechanisms have been found to significantly encourage sustainable behaviours (Flemming et al., 2008). Yet, the challenge lies in predicting the long-term impact of these user interventions, as ecological commitments are complex, and creating truly sustainable systems may rely on both technological solutions and intangible user actions (Uskoković, 2008).

To promote a more sustainable society, it is crucial to rethink how we communicate information and to encourage the development of new skills, behaviours, and values, areas in which this project aims to contribute. It is therefore essential to educate users by equipping them with the necessary knowledge to make informed decisions. **The goal of this thesis was to empower users with the tools and information that allow them to actively contribute to building a sustainable future.** The more accessible and understandable the information, the greater our knowledge and ability to make conscious and sustainable choices.

Working on **this project has provided significant learning opportunities that will be valuable for future projects as a service designer.** The integration of sustainability into service design, along with the focus on human-centered approach, has allowed me to develop a holistic perspective on how to create services that align with both user needs and environmental goals.
One takeaway is the importance of stakeholder engagement. In future projects, I will prioritise early involvement of diverse stakeholders that can contribute with important insights.
The use of AI and data-driven systems in this project has also expanded my understanding of how technology can be leveraged to create personalised and efficient services, and it expanded my skills in integrating AI to enhance user experiences.
This will be a key focus in future work, as **ensuring adaptability and continuous improvement is vital to the long-term success of any service.**
Lastly, this project has deepened my understanding of sustainable design principles, particularly the need for balancing environmental, social, and economic factors. This balance will continue to inform my approach in future projects, ensuring that services contribute positively to both users and the broader ecological and social systems in which they operate.

In summary, the project aimed to develop a solution that delivers tangible benefits to people while promoting environmental sustainability, emphasising that value is driven both by user needs and a clear, sustainability-oriented purpose. Through the use of AI and human-centered approaches, the proposed solution offers a practical method for encouraging more eco-friendly lifestyles within the food industry. The combination of technological advancements and human involvement is crucial for creating a sustainable future in a balanced and long-lasting way.

CHAPTER 11

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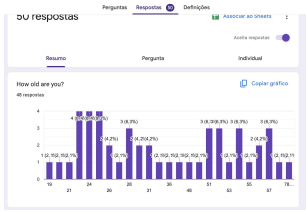
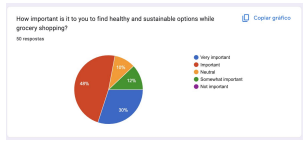
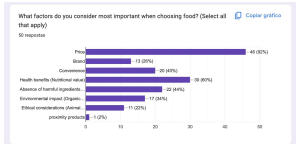
CHAPTER 12

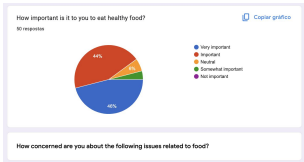
Appendix

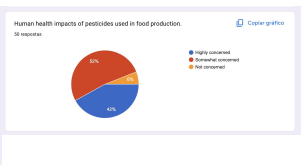
1 Online Survey

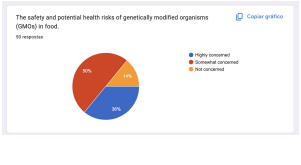


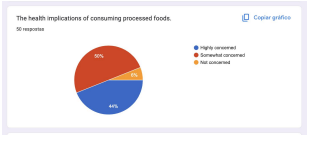


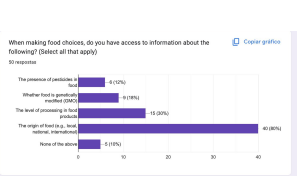


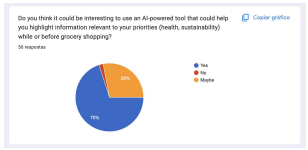


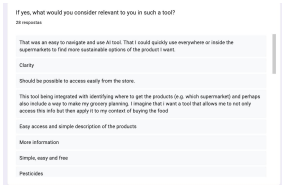


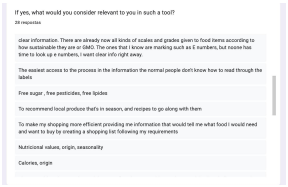


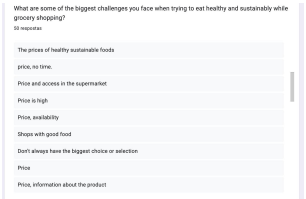


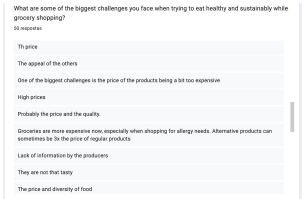


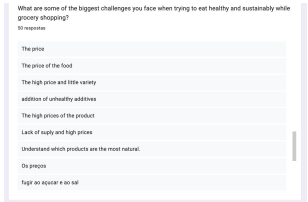


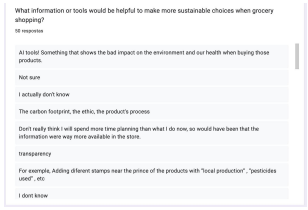


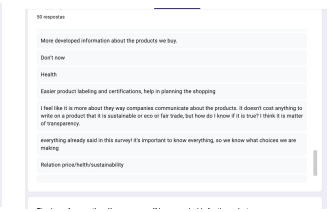


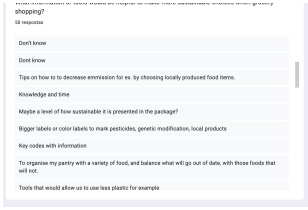


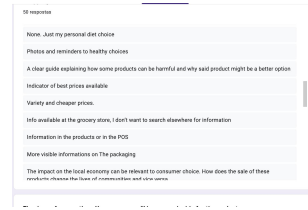


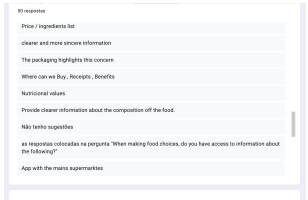












2 workshop

Workshop Invitation

Hey (friend),

I'm writing my Master's thesis and I'm exploring how can AI be integrated to support people with valuable information about the sustainable level of the products in order to help them make more sustainable choices when buying groceries.

I'm conducting a workshop on the **17th of April** from-**15:00 to 17:00h** at the **CPH Village** in Vesterbro (Otto Busses vej, 139, 2450 København)!
Feel free to call 52753132 if you need help getting here.

I'll be organising activities where you can brainstorm and discuss AI alternatives that assist people in selecting healthier and more sustainable products tailored to their dietary needs. To encourage this discussions and reflections, snacks and cake will be provided as incentives.

I will take pictures during the workshop as well, so if you decided to come, I'll send you a consent form to sign, and if you don't feel like consenting to that, please let me know!

Please let me know if you can come by Friday, so I can plan ahead. Hope to see you there <3

3 Survey for stakeholders

What is the name of the company you work for and what's you position inside the company?

2 respostas

Gram & Nybøl Godser - Owner

LA International ApS - CEO

Current Supply Chain Practices

Does the company currently provide any form of supply chain transparency to consumers?

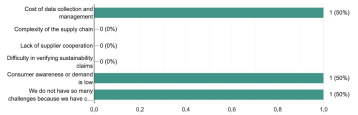
Copiar gráfico

2 respostas

What challenges do the company faces in providing detailed supply chain transparency? (Select all that apply)

Copiar gráfico

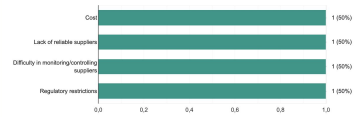
2 respostas



What are the biggest barriers the company faces when trying to implement sustainable practices within the supply chain? (Select all that apply)

Copiar gráfico

2 respostas



Do you believe consumers are willing to pay a more for products with clearly demonstrated sustainability and supply chain transparency?

2 respostas

Yes

No, consumer are not willing to pay extra.

Future Plans and Perspectives

What information do you think is most valuable to consumers when it comes to supply chain transparency?

2 respostas

Openness in how you produce things

Carbon emissions used in the supply chain

Is there anything else you would like to share regarding your company's approach to supply chain transparency or sustainability?

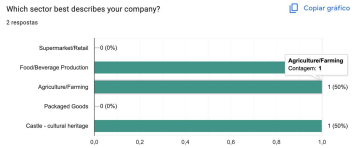
0 respostas

Ainda não existem respostas a esta pergunta.

Which sector best describes your company?

Copiar gráfico

2 respostas



If yes, what type of information do you provide? (Select all that apply)

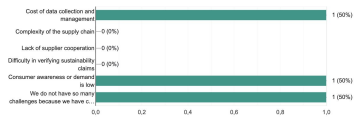
Copiar gráfico

2 respostas

What challenges do the company faces in providing detailed supply chain transparency? (Select all that apply)

Copiar gráfico

2 respostas



Consumer Trends and Market Perception

How would you describe consumer interest in sustainable and transparent supply chains within your market?

Copiar gráfico

2 respostas

Is your company planning to increase the level of supply chain transparency in the future?

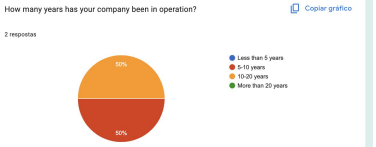
Copiar gráfico

2 respostas

How many years has your company been in operation?

Copiar gráfico

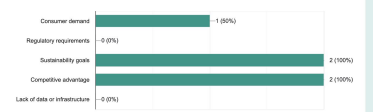
2 respostas



What is the primary reason that the company provides (or doesn't provide) supply chain transparency?

Copiar gráfico

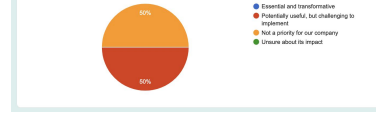
2 respostas



How do you see the role of technology in improving supply chain transparency?

Copiar gráfico

2 respostas



Do you believe that providing more detailed supply chain transparency would increase consumer trust in your brand or store?

Copiar gráfico

2 respostas

What do you think needs to happen in the industry to make supply chain transparency a standard practice?

2 respostas

That we trust each other and find out that the more we share and are transparent the more we can grow.

Regulatory push

What specific actions or policies (from governments, consumers, or industry leaders) would motivate your company to invest more in supply chain transparency?

1 resposta

That all the sectors come to us and see how we do things.

4 Sketches for Syoryboard