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MESTRADO EM ENGENHARIA DE SERVIÇOS E GESTÃO

Designing AI-Enabled Self-Service

Madalena Maria Mesquita Romano da Cunha

Master Thesis

Supervisor at FEUP: Prof. Lia Patrício

Supervisor at Sumol+Compal: Carlos Costa Moreira

U.PORTO

FEUP FACULDADE DE ENGENHARIA
UNIVERSIDADE DO PORTO

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Abstract

The emergence of Artificial Intelligence (AI) technology has transformed service industries by facilitating instant data collection, analysis, and forecasting. Despite this, there is a need for effective approaches to designing AI-Enabled Self-Services. To address this research gap, a new service design method was introduced and implemented in a Food and Beverage company. By leveraging seamless connectivity and advanced information systems, AI can enhance the Self-Service experience. The findings contribute to understanding AI's potential in transforming self-service technologies and emphasise the integration of service design principles to optimise operational efficiency and enhance customer experiences. By adopting this service design method, companies can leverage AI to provide personalised and seamless self-services. The insights gained from this study have implications for industries seeking to enhance their self-service offerings through AI.

Keywords: Artificial intelligence, self-service technologies, service design.

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Table of Contents

List of Figures

List of Tables

List of Abbreviations

AI	Artificial Intelligence
AI-SS	Artificial Intelligence-Enabled Self-Service
ATM	Automated Teller Machine
CVC	Customer Value Constellation
DL	Deep Learning
DSR	Design Science Research
MDS	Multi-Dimensional Scaling
MINDS	Management and Interactions Design for Service
ML	Machine Learning
MSD	Multi-Level Service Design
MVP	Minimum Viable Product
RPA	Robotic Process Automation
SD	Service Design
SD4BPR	Service Design for Business Process Reengineering
SD4VN	Service Design for Value Networks
SDCS	Service Design for Companies Undergoing a Servitization process
SEB	Service Experience Blueprint
SSA	Service System Architecture
SSN	Service System Navigation
SST	Self-Service Technology
TAM	Technology Acceptance Model

1 Introduction

This introductory chapter provides an overview of the project's background and research objectives. Additionally, the chapter introduces Sumol+Compal, a Portuguese food and beverage company where this thesis was conducted. Lastly, the report's structure is briefly outlined.

1.1 Project Background

The COVID-19 pandemic has accelerated the adoption of digital technologies, compelling companies to develop new strategies that recognise the strategic importance of technology in their operations (Laberge et al., 2020). To stay competitive, companies must leverage technological advancements to transform their ability to understand and meet customer needs while delivering offerings (Laberge et al., 2020). Artificial intelligence (AI) has become prevalent in various service industries, enhancing operational efficiency and customer experience (Prentice et al., 2020; Ameen et al., 2021). AI has revolutionised business operations by enabling real-time automated data collection, analysis, and prediction (Dogru & Keskin, 2020). Businesses have achieved seamless connectivity across multiple locations by integrating advanced information systems like cloud storage, the Internet of Things, wireless technologies, and affordable sensors (Dogru & Keskin, 2020). This connectivity allows for gathering real-time demographic, geographic, and behavioural consumer data through smart devices, point-of-sale systems, mobile applications, and sensors (Dogru & Keskin, 2020). These technological advancements have led experts to argue that we are currently experiencing the fourth industrial revolution, where technology blurs the boundaries between the physical, digital, and biological worlds (Schwab, 2017; Huang & Rust, 2018). Research indicates that the advancement of technology brings predictable consequences, such as increasing adoption of self-service technologies. Self-service technologies (SSTs) refer to technological interfaces that enable customers to access services independently without direct employee involvement (Meuter et al., 2000). AI-enabled self-service technology offers several distinct advantages over traditional SST. Companies like Coca-Cola utilise artificial intelligence in vending machines to provide innovative services, deliver customised solutions to customers, and enhance operational efficiency by analysing the data generated through this technology (Chen et al., 2021). This thesis seeks to contribute to service research by developing a method for designing AI-enabled self-services, using the case of Sumol+Compal, a Portuguese food and beverage company.

1.2 Research Objectives

An extensive literature review on AI in services, self-service technologies, and service design methods and models has identified a research gap. There is a lack of specific approaches to support the design of AI-enabled self-services. This gap forms the basis for the research objectives of this dissertation, which aims to use the service design approach to address the following research question:

- *How can service design methods and models be adapted to design new AI-Enabled Self-Services?*

1.3 Study and Project Development at Sumol+Compal

Sumol + Compal is a food and beverage company with 16 brands across six segments, including juices and nectars, soft drinks, water, snacks, vegetables, and alcoholic drinks. With approximately 1,350 employees, the company has a significant domestic and international presence, operating in over 70 countries. To adapt to the rapid growth of technology in recent years, Sumol + Compal has implemented a digital transformation program, which encompasses two main initiatives: digitisation and innovative initiatives. The digitisation initiatives focus on implementing proven technology to improve efficiency and resource allocation. In contrast, the innovative initiatives aim to explore unproven or emerging technology to create new products or services and reshape the entire value chain. Within the context of Sumol + Compal's innovative initiatives, there is a particular interest in exploring the future of vending machines using AI. The company recognises the potential of AI in revolutionising the vending machine experience and intends to investigate the opportunities presented by this technology. Thus, they aim to create a new service with smart vending machines that can enhance customer experience and drive business growth.

1.4 Report Outline

This dissertation paper comprises six chapters, each serving a distinct purpose. The first chapter, Introduction, provides an overview of the project background and research objectives. In the second chapter, Literature Review, the existing research and theoretical foundation related to the study's topic are thoroughly explored. The third chapter, Methodology, outlines the research approach, with Design Science Research serving as the guiding framework. The fourth chapter presents a detailed method for designing AI-enabled self-services, following the Design Science Research methodology. The fifth chapter showcases the successful application of this

method in a Food and Beverage Company, specifically Sumol+Compal. Finally, the last chapter summarizes the key findings, draws conclusions, and suggests avenues for future research.

2 Literature Review

This chapter develops the theoretical base of this study. Literature review starts with an introduction on Artificial Intelligence, followed by a review of research on Self-Service Technologies. Finally, it discusses Service Design methods and models.

2.1 Artificial Intelligence in Services

Artificial intelligence (AI) has been defined in various ways in the literature. Huang and Rust (2018) state that AI is "machines exhibiting facets of human intelligence". Paschen et al. (2019) define AI as “the ability to process and transform data into information to inform goal-directed behaviour”. Dwivedi et al. (2019) note that AI is designed to imitate the capability of human power while exceeding its ability for accuracy.

The literature distinguishes three AI categories: robotic process automation (RPA), machine learning (ML), and deep learning (DL) (Hollebeek et al., 2020). RPA deals with automating existing labour-intensive processes (Huang & Rust, 2018). ML solves tasks using training data and predicts patterns without explicit instructions (Janiesch et al., 2021). DL relies on artificial neural networks to mimic human brain functions, which allows it to replicate human thought processes and decision-making (Hollebeek et al., 2020). According to Marr (2020), the Artificial Intelligence technology stack comprises four main layers or stages: Data Collection, Data Storage, Data Processing and Analytics, and Data Output and Reporting.

There is growing interest among researchers regarding the AI revolution. The widespread implementation of AI in multiple industries has raised concerns about potential job losses in the future (Acemoglu & Restrepo, 2017).

According to Huang and Rust (2018), the replacement of jobs by AI can be explained through four key intelligences: Mechanical, Analytical, Intuitive, and Empathetic (figure 1). The development of AI technology relies on the gradual improvement of these intelligences in a specific order. Mechanical AI is good for repetitive tasks, but it has limited learning and adaptability (M. Huang & Rust, 2020).

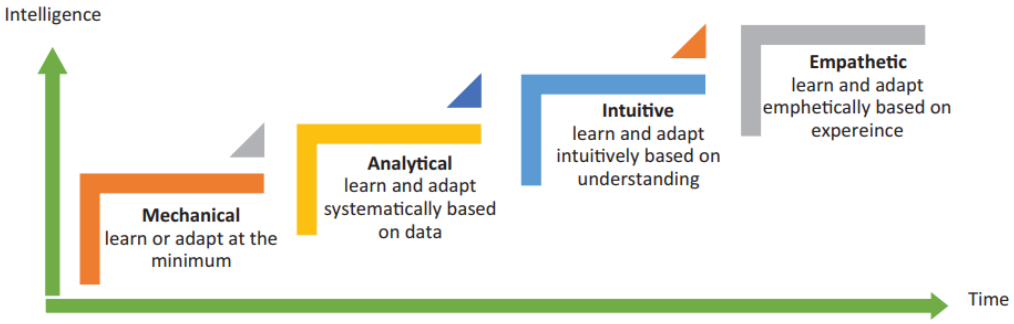


Figure 1 The four intelligences proposed by M. Huang and Rust (2018)

Analytical AI services are now widely available to customers, enabling to process and learn from information for effective problem-solving (M. Huang & Rust, 2018; Flavián et al., 2021). Intuitive intelligence is essential for success in providing complex and personalized services, requiring creative thinking and adaptability (M. Huang & Rust, 2018). Empathetic intelligence involves understanding and responding to emotions in a suitable way. It includes communication, relationships, leadership, teamwork, and cultural diversity (M. Huang & Rust, 2018).

2.2 Impact of AI on Customer Experience

AI helps businesses gather customer data to improve experiences, leading to faster decisions, better engagement, and ultimately meeting the requirements for great customer experience (Zaki, 2019; Ameen et al., 2021). The customer experience is a holistic and complex phenomenon encompassing a customer's cognitive, emotional, physical, and social responses to a service provider, spanning their entire journey across multiple retail channels (Verhoef et al., 2009).

AI has a significant and far-reaching impact on human lifestyles and habits, influencing nearly every aspect of daily life, and its widespread popularity is partially attributed to its high level of personalisation (Kumar et al., 2019). Personalization refers to delivering content, products, and services tailored to an individual's specific characteristics and requirements (Xiao & Benbasat, 2007). This approach is becoming increasingly popular because it offers a unique experience by tailoring personalised options for each user, treating them as individuals (Chen et al., 2021).

According to Chellappa & Sin (2005), the successful personalisation of services depends on two factors: business abilities to acquire and process consumer information and consumer willingness to share information and use personalized services. Awad and Krishnan (2006)

found that the significance of personalization advantages and privacy concerns varies based on the type of service. With personalized services, the clear advantages for consumers surpass the privacy concerns, however, it's the opposite for personalized advertisements (Lee & Rha, 2016).

According to a study conducted by Ameen et al. (2021), individuals who utilize AI-powered services may encounter drawbacks such as decreased human interaction, privacy concerns, loss of control, and negative emotions. However, the study also discovered that brands and their technologies are more likely to gain trust when the AI-powered services are customized, convenient, and of superior quality.

2.3 Self-Service Technologies

Self-service technologies (SSTs) are increasingly changing the way customers interact with firms to create service outcomes (Meuter et al., 2000). According to Meuter et al., (2000), selfservice technologies (SSTs) are ‘‘technological interfaces that enable customers to produce a service independent of direct service employee involvement’’. Traditional ‘‘high-touch and low-tech’’ interpersonal service encounters are being gradually supplemented, or even replaced, by a range of ‘‘high-tech and low-touch’’ SST interfaces (Blut et al., 2016). SSTs can be found in a variety of industries, including banking, retail, and transportation. Examples include using ATMs (Automated Teller Machines), buying movie tickets at a kiosk, paying bills at a self-service terminal, checking out of a hotel automatically, and making purchases or accessing services online (Bitner et al., 2002). The COVID-19 pandemic, which broke out in early 2020, significantly impacted the global economy. Social distancing and avoiding large gatherings were implemented to control the spread of the virus, which not only affected the behavior of individuals but also accelerated the adoption of new service models across various industries (Guan et al., 2021). Additionally, while consumers were already familiar with self-service, the pandemic has driven increased usage due to new motivation (Wang et al., 2022).

As more research on self-service technologies has emerged, establishing a classification system has become necessary. In 1994, Dabholkar proposed a classification system for evaluating technology-based services in terms of their potential for meeting customer needs and their marketing potential (Dabholkar, 1994). Dabholkar's scheme builds on the work of Lovelock and has been shown to be useful across multiple service industries (Cunningham et al., 2008).

Meuter et al., (2000) categorized Self-Service Technologies (SSTs) based on the type of technology interface used by companies to interact with customers and the customer's intended use of the technology. These interfaces include telephone-based technologies, online interfaces,

self-standing kiosks, and video/CD technologies (Meuter et al., 2000), which can be seen as too outdated to employ today.

Cunningham et al. (2008) presented a different approach to studying how consumers perceived self-service technologies by using the multi-dimensional scaling (MDS) technique to categorize twelve different self-service technologies based on eleven dimensions: level of the physical component of the product, level of customer-employee interaction, separation of service production and consumption, level of supplier risk, ease of switching to new providers, service provided to a person or object, the formality of the relationship between the service provider and customer, continuous or discrete service delivery, level of service customization, level of employee judgment in choosing the service, and level of service convenience. The study aimed to classify these technologies based on separability and customization and provide managers with insights into how their self-service technologies might be perceived by consumers. The results indicated that two dimensions, customization vs. standardization and separability vs. inseparability, explained a significant portion of the variance in classifications. The study concluded by presenting a customer-based classification of six categories of self-service technologies, which can be found in table 1 (Cunningham et al., 2008).

Table 1 Customer-based SSTs classification. Source: (Cunningham et al., 2008)

	Customized	*Standardized*
Separable from product/service	*Arline reservation* *Online car buying* *Online auctions*	
Moderately separable	*Distance education* *Online banking*	*Pay at the pump* *Retail self-scanning* *Internet search* *Tax software* *ATMs*
Inseparable from product/service	*Online brokerage*	*Interactive phone*

2.3.1 Factors Influencing Customer Use and Adoption of SST

Different authors have investigated several theories that provide a conceptual foundation for SST acceptance studies (Lin et al., 2007; Weijters et al., 2007; Blut et al., 2016). The Technology Acceptance Model (TAM) is a commonly used framework to comprehend and forecast the acceptance of novel technologies, including SSTs. (Lin et al., 2007). The model is based on two key concepts: perceived usefulness and perceived ease of use. According to Davis, (1989), perceived usefulness is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" and perceived ease of use, in contrast, refers to "the degree to which a person believes that using a particular system would

be free of effort". Table 2 summarizes the main variables that affect the use of SST, which have been discussed in the SST research (Guan et al., 2021). In their study, Guan et al. (2021) explored the impact of the physical environment, also known as the servicescape, on the usage of self-service technology. They conducted a survey of 485 individuals at different bank branches in Guangzhou and found that a favorable servicescape can result in positive customer attitudes and increase the likelihood of using SST.

Table 2 Main variables that affect the use of SST. Source: (Guan et al., 2021)

Antecedents	*Main Variables*
Technology Factors	perceived usefulness, perceived ease of use, perceived ride perceived reliability, perceived enjoyment and novelty, speed of service delivery, fun, perceived control, and the service quality of sell-service technology
Customer Factors	gender, consumer readiness, technology readiness, technology anxiety, technology and service expertise, personal contact needs, optimism. and innovativeness
Situational Factors	perceived crowdedness, traditional checkout queue length and queue waiting time, perceived time pressure, role clarity, and consumer tolerance of waiting time

Bitner et al., (2002) developed a Model of SST Adoption (figure 2), which consists in six stages: awareness, investigation, evaluation, trial, repeated use, and commitment. These stages are impacted by the "customer's readiness" to adopt the technology. According to Meuter et al., (2005) customer readiness encompasses of role clarity, motivation, and ability.

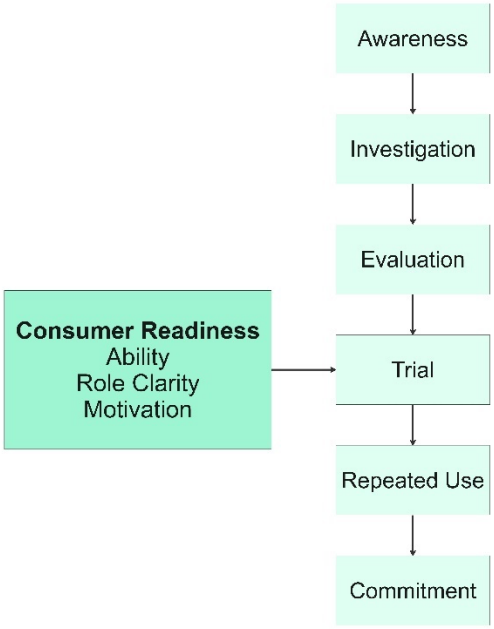


Figure 2 Model of SST Adoption- Source: (Bitner et al,. 2002)

2.3.2 Determinants of Customers Satisfaction and Continual Use of SST

Bitner et al. (2002); Beatson et al., (2007); and Verhoef et al. (2009); mentioned in their studies that a positive user experience plays a crucial role in determining customers' decisions to continuously use SST. Contrarily, negative experiences with SST decrease the probability of full adoption. A survey conducted by Bitner et al. (2002) gathered 823 written descriptions of clients about satisfactory and unsatisfactory SST experiences. They concluded that the highest percentage of negative stories resulted from an SST failure: "While customers appreciate the convenience and easy access of SSTs, all of these advantages are suddenly lost when SSTs fail, and most often the customer is forced to return to more conventional service delivery options… A major finding of our research is that service recovery systems are almost nonexistent for SSTs. In most cases, when the process or technology fails, there is no way to recover on the spot. Typically, customers are forced to call or to come in person to have their problem dealt with. They hate this because it is exactly what they were trying to avoid!". However, if SST effectively addresses problems, customers are likelier to continue using it (Bitner et al., 2002).

2.4 Service Design

Service Design (SD) is a human-centered, holistic, creative and iterative approach to service innovation (Blomkvist et al., 2010; Meroni & Sangiorgi, 2011).

Service Design integrates Service Research and Design practices to create services that meet the needs of customers and providers, aiming to improve the overall service experience by considering the interactions and expectations of all stakeholders, emphasizing collaboration with customers to generate value propositions and taking into account the holistic nature of the service system encompassing people, processes, technology, information, and resources (Patrício & Fisk, 2013).

The iterative process of SD generally follows a similar structure, beginning with a stage of exploration and study, and concluding with the implementation and delivery of a solution (Foglieni et al., 2018). Patrício and Fisk (2013) propose that a service design process follows four main stages: (1) inspiration, (2) ideation, (3) reflection through prototyping and testing, and (4) implementation (Patrício & Fisk, 2013).

Service Design takes a holistic approach, considering people, technology, processes, and interactions, and how they work together (Patrıcio et al., 2011; Banica & Patricio, 2020). Collecting a comprehensive range of data is essential to understand the service system (Patrício & Fisk, 2013). There are several ways to collect this information, such as administering

questionnaires, conducting interviews, analyzing content, observing, and organizing focus groups (Birmingham & Wilkinson, 2003).

2.4.1 Service Design Methods and Models

The methodologies of Service Design offer significant assistance in facilitating organizational change, particularly in the transition from conceptualization to execution (Banica & Patrício, 2020). Several methods and models have been developed in the field of Service Design (Patrício et al., 2011; Grenha Teixeira et al., 2017; Patrício et al., 2018; Banica & Patrício, 2020; Lima and Teixeira, 2020). Table 3 provides an overview of the SD methods, encompassing the different stages and corresponding models.

Patrício et al. (2011) introduced the Multilevel Service Design (MSD) method, which facilitates the creation of service solutions across three levels: the service concept, the service system, and the service encounter. To ensure a great customer experience, MSD implements a thorough four-step process. The first step is to conduct a thorough examination of the experience. The second step is to create a Service Concept by analyzing current offerings and constructing a Customer Value Constellation (CVC). The third step is to design the Firm's Service System based on its CVC position using the Service System Architecture (SSA) and Service System Navigation (SSN) models. Lastly, the fourth step is to design service encounters by utilizing the Service Experience Blueprint (SEB) to illustrate interactions, failures, waiting points, and service links (Patrício et al., 2011).

The Management and Interactions Design for Service (MINDS) method builds upon the MSD and facilitates the creation of innovative technology-enabled services (Grenha Teixeira et al., 2017). MINDS integrates management perspective models that emphasize developing new value propositions and coordinating multiple service interfaces, along with interaction design perspective models focusing on technology usage within its context (Grenha Teixeira et al., 2017).

The SD4VN method, proposed by Patrício et al. (2018), involves mapping the value network to identify relevant actors and their relationships, examining key actors' experiences and connections, and designing an integrated service offering for the value network. This includes creating a service concept for each actor, designing their interconnections, and forming an integrated value network service concept. The value network service architecture is also designed to facilitate interactions among the actors while striving for a balanced centricity approach (Patrício et al., 2018).

Banica and Patrício (2020) introduced a method called Service Design for Business Process Reengineering (SD4BPR). This approach aims to enhance efficiency and customer experience by redesigning business processes. The method comprises three stages that merge design thinking and service design techniques. The initial stage, exploration, involves mapping the current process (AS-IS). The second stage, ideation and prototyping, involves modeling the desired future process (TO-BE) and generating ideas for improvement. The last stage, implementation possibilities, focuses on the practical implementation of the redesigned process (Banica & Patrício, 2020).

Lima and Teixeira (2019) proposed the Service Design Method for Companies (SDCS) which involves five stages: exploration, development, pilot, implementation, and service management. The method focuses on understanding the customer experience in the exploration phase and testing the service with a real client in the pilot phase to make necessary adjustments before implementation. The service management phase facilitates ongoing improvements (Lima & Teixeira, 2020).

Table 3 Service Design Methods and Models

Service Design Methods	*Stages*	*Models*
Multilevel Service Design (MSD) (Patrício et al., 2011)	Designing the service concepts; Designing the service system; Designing the service encounter;	Customer Value Constellation (Patrício et al., 2011); Service System Architecture (Patrício et al., 2011); Service System Navigation (Patrício et al., 2011); Service Experience Blueprint (Patrício, Fisk, and Cunha 2008)
Management and Interactions Design for Service (MINDS) (Grenha Teixeira et al., 2017)	Structured along MSD's three levels (Patrıcio et al., 2011), integrates and leverages: Management; Interaction Design;	Combination of Models: Customer Value Constellation (Patrício et al., 2011) and Affinity Diagram (Beyer and Holtzblatt 1997).; Service System Navigation (Patrício et al., 2011) and Story/Board Scenario (Carroll 2000); Service Experience Blueprint (Patrício, Fisk, and Cunha 2008) and UX/Wireframe Sketch;
Service Design for Value Networks	Mapping the Value Network; Understanding the experience, network goals,	Actor network map (Morelli and Tollestrup 2007) ;

(SD4VN) (Patrício et al., 2018)	activities, and interactions of multiple actors; Designing the value network service concept and architecture;	Actor network activities and interactions; (Patrício et al., 2018) Actor network goals (Patrício et al., 2018); Customer Value Constellation (Patrício et al. 2011); Value network service concept (Patrício et al., 2018) Value network service architecture (Patrício et al., 2018)
Service Design for Business Process Reengineering (SD4BPR) (Banica & Patrício, 2020)	Mapping the AS-IS process; Modelling the TO BE process; Exploring implementation possibilities;	Customer Experience Diagram (Banica & Patricio, 2020); Adapted Service Experience Blueprint (Patrício, Fisk, and Cunha 2008; Banica and Patricio, 2020); Service System Architecture (Patrício et al., 2011);
Service Design Method for Companies Undergoing a Servitisation process (SDCS) (Lima & Teixeira, 2020)	Exploration; Development; Pilot; Implementation; Service management;	Customer Value Constellation (Patrício et al., 2011); Service System Architecture (Patrício et al., 2011); Service Experience Blueprint (Patrício, Fisk, and Cunha 2008)

3 Methodology

This section provides an overview of Design Science Research (DSR) and explains why this methodology has been adopted. Subsequently, it presents the application of the Design Science Research Process (Peffers et al., 2007; Teixeixa et al., 2019).

3.1 Selection of Design Science Research as the Methodology

Design Science Research involves understanding organisational phenomena in context, promoting the creation of innovative artifacts (Hevner et al., 2004). These artifacts encompass constructs, models, methods, and instantiations. Artifacts are designed to address real-world problems and are evaluated based on their effectiveness in solving those problems (Hevner et al., 2004). Constructs provide the language to define problems and solutions; models are representations of the real-world situation; methods define processes; and instantiations are applications showing that the artifacts can be implemented in a working system (Hevner et al., 2004).

Teixeira et al. (2016) conducted a study that presents compelling evidence supporting the extension of DSR into Service Research. This dissertation aims to introduce a new method (artifact) for the development of AI-Enabled Self-Services. Considering the project's nature, the most suitable methodology to employ is Design Science Research.

3.2 Application of the DSR Process

Peffers et al. (2007) proposed an iterative process that serves as a framework for conducting Design Science Research. This process should be followed iteratively and include six steps: identify problem and motivate; define objectives of a solution; design and development; demonstration by using the artifact to solve the problem; evaluation; and communication through scholarly and professional publications (Peffers et al., 2007). Teixeira et al. (2019) proposed a step-by-step approach for service design research, based on Peffers et al.'s (2007) DSR process. Each of these stages was followed in this thesis.

1. **Identifying the class of problems and the solution objectives.** The first step involves identifying the class of problems and defining the solution objectives (Teixeira et al., 2019). This involves defining the research problem and justifying the value of a solution (Peffers et al., 2007). When defining the goals of a DSR solution, they can be described in two ways - either qualitatively, by explaining how the new artifact will better address the problem, or quantitatively, by determining how much better the desired solution should be compared to the current one (Peffers et al., 2007). Through a literature review

on AI in services, self-service technologies, and service design methods and models, a gap in the literature regarding methods that support the design of AI-enabled self-services was identified. This problem is also relevant in various real-world contexts, especially as more companies seek to incorporate AI into their services. It is crucial to have methods that offer support in the design of these services. In this context, this dissertation aims to fill this gap and contribute to research in service design.

2. **Designing and developing a solution to a class of problems.** The second step focuses on designing and developing a solution for the identified class of problems (Teixeira et al., 2019). In this phase, the objective is to create and design the artifact. For this, it is necessary to define its functionality, its architecture, and the creation of the artifact itself (Peffers, 2007). This phase is exceptionally well suited to service design research since it typically uses visual models in both research and practice (Teixeira et al., 2019). The method developed for designing AI-enabled self-services was developed based on the Design Science Research (DSR) methodology, combining, and adapting service design models. The method follows the design thinking iterative process (Brown, 2008) and consists of five steps: Problem Framing, Understanding and Mapping of the AS-IS Experience, Ideating and Mapping the TO-BE Process, Prototyping and Testing, and finally, Service Implementation and Monitoring.

3. **Applying the artifact and evaluating.** The third step involves applying the artifact and evaluating its effectiveness (Teixeira et al., 2019). The application of the artifact involves using the artifact to solve one or more instances of the problem by using experimentation, simulation, case study, proof, or other appropriate activity (Peffers et al., 2007). The evaluation consists of observing and measuring how well the artifact supports a solution to the problem (Peffers et al., 2007). DSR can use various quantitative and qualitative methods to evaluate its artifacts (Peffers et al., 2012; Teixeira et al., 2019). In this context, the developed method was applied in a real context in a food and beverage company. Qualitative methods were used in different phases of the method, including data collection through interviews, and data analysis, to gain an in-depth understanding of the customer experience (Busetto et al., 2020). The evaluation of the method's effectiveness was achieved through the successful development and implementation of the service, following the various stages of the method. Positive feedback was obtained from the stakeholders involved in the process.

4. **Communicating.** Finally, the fourth step involves communicating the results obtained from the previous steps (Teixeira et al., 2019). An important component of a DSR

approach is disseminating the findings to academic and practitioner audiences (Teixeira et al., 2019). The present research was communicated to both business and academic audiences. The method was applied in a real-world setting within a food and beverage company, allowing for its dissemination to business audiences. In terms of academic communication, the developed method was shared through the publication of this dissertation at FEUP (Faculty of Engineering, University of Porto).

4 A Method for AI-Enabled Self-Service Design

AI-Enabled Self-Service Design (AI-SS Design) method addresses the difficulty of assisting businesses in adopting AI-Enabled Self-Service. This approach follows the design thinking iterative process, which involves several stages: exploration, ideation, reflection, and implementation (Brown, 2008).

AI-SS Design consists of five steps (figure 3): Problem Framing, Understanding and Mapping of the AS-IS Experience, Ideating and Mapping the TO-BE Process, Prototyping and Testing, and finally, Service Implementation and Monitoring.

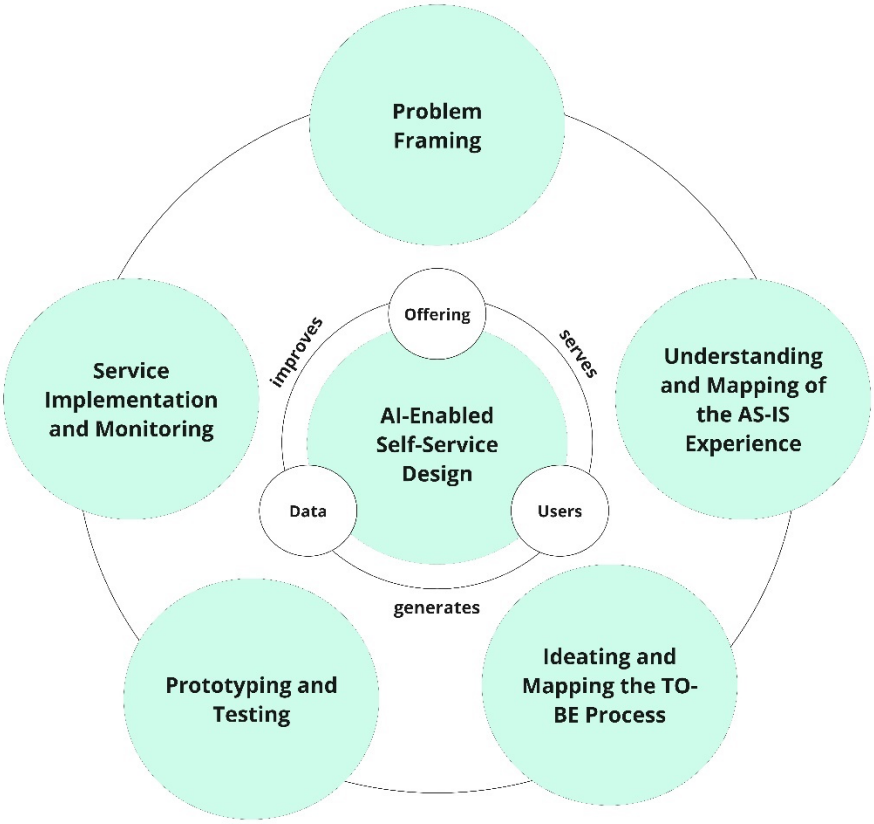


Figure 3 AI-SS Design Method

Data collection is suggested throughout the various stages of the method, for which several methods can be used, including interviews, observation, and focus groups (Birmingham & Wilkinson, 2003). Nvivo is a valuable tool for qualitative data analysis as it allows for data categorisation and pattern identification.

4.1 Problem Framing

Designers start by breaking down problems into smaller subproblems and transforming them into well-defined design challenges. This is the first step in the design process and involves

Problem Framing (Kvan & Gao, 2007). The stage of Problem Framing holds great importance in the design of AI-Enabled Self-Services due to the unique challenges and complexities associated with integrating AI into service offerings.

To properly frame the problem, it's important to analyze the current market. This includes investigating the best practices used by other organizations, identifying relevant use cases, and gaining insights into the available technology and its potential applications. Literature review (Knopf, 2006) and benchmarking (Anand & Kodali, 2008) are helpful tools to achieve these goals.

To fully understand the potential of a technology in an organizational setting, it's recommended to conduct an exploratory study with relevant stakeholders. This includes analyzing the organization's specific needs and requirements to ensure coherence with its objectives. A diverse group of experts from various fields, including engineering, data science, and marketing, should be included. It's also important to involve potential users to identify areas for improvement and enhance the overall user experience. Qualitative analysis methods, such as semi-structured interviews, focus groups, and observation, can be used to collect data (Birmingham & Wilkinson, 2003).

Once data analysis is complete, it's crucial to effectively present and communicate the findings to the company's executive management team. The purpose of this presentation is to suggest the adoption of a service and seek approval for its implementation. To minimize risks associated with AI-enabled self-service solutions and achieve optimal results, it is crucial to choose a low-risk service that can be developed in a controlled and small-scale environment, recognizing the inherent difficulties in the early stages of working with AI. This approach allows for testing, refining, and gathering valuable data, which plays a vital role in training and improving the AI models.

4.2 Understanding and Mapping of the AS-IS Experience

After identifying the desired service to be implemented, the next step is to understand and map out the current experience, also referred to as the AS-IS experience. For this purpose, the method suggests meeting with key informants to gather information about the actors involved, their primary activities, and the tools. The *Actor Network Map*, introduced by Morelli and Tollestrup (2007), provides a clear overview of the actors and emphasises the roles and relationships among them. The *Actor Network Map* serves as a starting point for the next phase, which includes conducting exploratory studies with key actors involved. To better understand actor's current experience and identify any pain points, the method recommends using

qualitative tools such as interviews, observations, and workshops (Birmingham & Wilkinson, 2003).

Due to the large amount of information generated, visual tools are essential for effectively identifying opportunities within the current AS-IS service. The proposed method suggests using an *adapted Service Experience Blueprint (SEB)*. Service blueprinting is recognized as a valuable service design tool that prioritizes a process-oriented approach centered on the customers' needs (Bitner et al., 2008). SEB emphasizes the role of the customer and visually demonstrates how various actors within the service system contribute to supporting this central role. However, when designing AI-Enabled Self-Services, it becomes crucial to understand the customer journey and the journeys of all actors involved in service delivery, whose experiences will also be impacted by AI-Enabled automation. Therefore, the SEB was adapted to incorporate the journeys of all relevant actors, recognising its importance in shaping the overall experience of the service. The modified SEB can represent both the AS-IS and the TO-BE processes, and an example of their application can be found in the next chapter.

4.3 Ideating and Mapping the TO-BE Process

During the third phase of the method the focus is on generating ideas and mapping the TO-BE process. This begins with conducting brainstorming sessions with key stakeholders to identify potential new roles for the various actors involved. With the help of AI, some tasks have been automated, and the analysis of extensive data has created new positions (M. Huang & Rust, 2018).

After completing the first step, it is necessary to map the new TO-BE process. The method suggests using an *adapted Service Experience Blueprint (SEB)* version. It's important to share this SEB with the key stakeholders and make necessary iterations until the Minimum Viable Product (MVP) (Moogk, 2012) version is achieved. In this phase, it's crucial to hold meetings with technology providers/developers to determine the feasibility of the projected functionalities for MVP implementation.

When considering AI technology, it is crucial to recognize that its progress relies on ample data and time to develop sophisticated features such as personalization . As a result, it is advisable to prioritize the development of mechanical and analytical intelligence functionalities initially. The implementation of intuitive and empathetic intelligence functionalities necessitates a significant amount of time and data for effective refinement (M. Huang & Rust, 2018). When creating the MVP, it's important to keep in mind the limitations and focus on functionalities that can be efficiently implemented within the given timeframe and resources. This approach

allows for testing the service's feasibility and, in future development phases, incorporating more advanced features based on user feedback and improvement of AI models.

4.4 Prototyping and Testing

The prototyping and testing phase have the same objective as this stage in the service design process. Due to the intangible nature of services, prototyping is crucial to provide users and the design team with a clearer understanding of the service concept (Patrício & Fisk, 2013).

The method suggests using physical prototypes as a low-cost yet effective method to prototype integrated solutions. Physical prototypes can be used to test the solution with customers, obtaining valuable feedback on the physical product and service components. Workshops can be conducted during the testing process to facilitate collaborative discussions and stakeholder involvement.

Prototyping allows for simulation of customer interaction, providing an opportunity to identify potential areas for improvement prior to implementation. The iterative approach of prototyping and testing ensures that the service design is continuously improved and aligned with stakeholder and end-user needs and expectations. Based on feedback, the prototype can be refined, necessary adjustments made, and further rounds of testing conducted.

4.5 Service Implementation and Monitoring

During the Service Implementation and Monitoring phase, it is essential to utilize the feedback collected from the prototyping and testing phase to ensure that the service is implemented effectively. The first recommended step is to arrange meetings with service managers and technology developers/providers to align the service functionalities to be implemented. This involves presenting the insights gathered during the prototyping and testing phase and defining the implementation functionalities based on customer and stakeholder feedback. It should be noted that not all feedback can be incorporated in the initial stage due to various factors, such as strategic management considerations and technological constraints. Hence, it is crucial to evaluate and prioritize the service functionalities to be implemented.

When a service is clearly defined, it's important to create a communication plan. This involves notifying the responsible team, which usually includes marketing and communication professionals, to effectively promote the service and devise a successful launch strategy. This includes creating appropriate communication materials and marketing campaigns to inform users about the AI-powered self-service solution that's being introduced.

Effective communication with all parties involved in service provision and ensuring they are adequately trained is a critical aspect of this phase. This guarantees that the technology is utilized efficiently, and a high-quality service is delivered to the customer. Training programs can cover various areas, from technology functionality to developing essential skills for effective customer interaction.

Inspired by the Service Management stage of the SDCS method proposed by Lima and Teixeira (2020), it is crucial to continuously monitor the effectiveness of the implemented service and identify areas for improvement. In the proposed method, the last step involves obtaining feedback from users and analyzing the data produced by the self-service AI solution. This feedback and data analysis are crucial in fine-tuning and improving the AI system. By gathering user feedback and analyzing the generated data, organizations can gain insights into user preferences, behaviors, and patterns. This feedback loop enables businesses to optimize their AI algorithms, enhance the accuracy of personalized recommendations, and improve the overall user experience.

5 Application of the Method in a Food and Beverage Company: The Case of Sumol+Compal

This chapter presents the application of the AI-SS design method in the practical context of Sumol+Compal, a food and beverage company.

5.1 Problem Framing

In the problem framing stage, the potential applications of smart vending machine technology in the context of Sumol+Compal were thoroughly explored. This phase concluded with the definition of the service to be implemented.

5.1.1 Exploring Smart Vending Machines Adoption: Case Examples

Several companies already adopt smart vending machine technology as a new business model. An example is Subway, which has installed this technology in universities, airports, and other high-foot-traffic locations throughout North America to sell its products. Using artificial intelligence and natural language processing, customers can interact directly with the machine and obtain product information. Shelves equipped with weight sensors ensure that customers are charged correctly, resulting in contactless and cashless transactions (Howard, 2022).

Coca-Cola is also implementing a vast network of smart machines in the United States and New Zealand. These devices provide data on inventory levels, customer behaviour, and machine conditions. As a result, Coca-Cola can manage inventory better, predict demand, and perform machine maintenance. The smart machines control temperature, record transaction history, and allow for dynamic pricing (Chen et al., 2021).

Although the technology has yet to be widely explored in Portugal, some companies are integrating the concept of smart vending with the creation of smart stores. An example of this is Galp, which, in partnership with Sensei, a Portuguese startup that supplies autonomous stores, has created a store in Lisbon with no employees attending to customers. The store has a network of installed cameras, shelf sensors, and artificial intelligence algorithms. Customers need to download the Sensei app or scan the QR code at the store entrance, retrieve products from the shelves, and the purchase is automatically completed (Prado, 2022). Pingo Doce has also opened a store at Nova SBE, where it is necessary to download the "Pingo Doce & Go Nova" app to enter, shop, and exit the store. After downloading the app, customers can retrieve products from the shelves and scan the barcodes of their purchases with their smartphones. Finally, with a payment method linked to their account, customers can leave without going through any checkout (Curvelo, 2019).

5.1.2 Benchmarking Analysis of Smart Vending Machines Technology Providers

This section presents an overview of the benchmarking process, encompassing identifying and evaluating key providers and examining the functionalities associated with smart vending machine technology. A benchmarking was conducted to compare the value propositions that different providers of smart vending machine technology offered.

First, research was conducted to find the leading technology providers in the industry. Subsequently, a subset of eight providers was selected for in-depth analysis and comprehensive comparison. The outcomes of this analysis were summarized in a table, which can be found in APPENDIX A.

The main functionalities being explored by smart vending machine manufacturers include incorporating intelligent sensors, enabling automated product recognition and being equipped with real-time data collection capabilities through internet connectivity. This technology integration offers multifaceted advantages in logistics optimization and enhanced customer experiences. By employing door-based systems instead of traditional code-based selection methods, smart vending machines facilitate direct consumer interaction with the products and enable seamless data collection. Consequently, consumer profiles can be established, providing a foundation for personalized experiences facilitated by artificial intelligence. However, it is important to acknowledge that the personalization process relies on many data, which may necessitate significant time investments due to associated constraints.

Based on the outcomes of the benchmarking analysis, one provider emerged as the most promising candidate, prompting further engagement through subsequent meetings and negotiations. The selection of this provider was based on their ability to offer tailor-made solutions and adapt to changing service requirements. Furthermore, the provider's proximity conferred an additional advantage, facilitating effective communication, streamlined logistics, and enhanced support throughout the envisioned partnership.

5.1.3 Exploratory Study

To gain a comprehensive understanding of the potential of smart vending machine technology from user and company perspectives, 15 semi-structured interviews were conducted. The sample comprised 5 users of traditional vending machines and 10 company members from various departments, including marketing, consumer insights, distribution channel managers, and human resources.

The interviews followed a predefined protocol, which can be found in APPENDIX B, and were audio-recorded and subsequently transcribed. Qualitative data analysis was conducted using NVivo software, a specialized tool for qualitative data analysis. The data were categorized and subcategorized, and a comparative analysis was performed to identify recurring patterns and themes. APPENDIX C presents a mindmap with the categories and subcategories identified through the NVivo analysis.

a) Exploratory Study with Users of Traditional Vending Machines

The analysis of interviews with users of traditional vending machines provided valuable insights into the attributes that users desire in a vending machine, as shown in Table 4, which includes illustrative quotes.

Table 4 Attributes that users desire in a vending machine

Desired Vending Machine	Quotes
Expanded Location Coverage	*"In some healthcare centers, the absence of these types of machines is noticeable... You spend a lot of time there, there are many unforeseen circumstances, and a machine like that would be very useful."* *"…a vending machine in football stadiums, because sometimes it's very difficult to go to the bar during halftime."*
Hands-On Product Experience	*"For me, an ideal vending machine would be one that I could open and see things up close... I can't consume milk or dairy products, and often, without seeing the label, I can't identify the ingredients."* *"Without having direct contact with the product, if it's not exactly what I wanted, there's no other option... It's not functional, it's not practical!"*
Flexible Payment Options	*"I would like to have the option of contactless, without having to open the MBWay app."* *"I would like to be able to pay with my smartwatch."*
Human-Like Interaction	*"It would be interesting to be able to talk to the machine... Today, I feel like eating something. What do you have to say to me?"* *"I would like you to talk to me about the products, creating a relationship with me as if you were Dona Maria from the grocery store..."*
Increased Product Variety	*"There is limited diversity in the product offerings..."* *"They never have healthy options. Since I'm aware of that, I always try to bring food from home."*
Customized Tips	*"If you always go to the same place, being able to set your default machine... this is my favorite machine and receiving notifications about available products... when they are restocked!"*

	"...imagine before heading to the machine, knowing what it has... I would like it to be like that online shopping experience where I can see if it has my size."

After reviewing the interview results, it has been confirmed that smart vending machines have a valuable proposition for customers. Unlike traditional vending machines, smart vending machines can feature door systems that enable customers to touch the products, verify labels and expiration dates, and have a wider selection of items. In traditional vending machines, product drops and space limitations limit the options available. By cross-referencing the literature review with the interview findings, it was also concluded that customers increasingly expect customization and tailored experiences. Additionally, the interviews revealed that vending machines are commonly utilized in situations where people have limited time and require quick and effortless solutions. Nonetheless, users often feel that these machines offer a limited product selection. These insights provide a solid foundation for understanding the value of smart vending machines and emphasize the importance of meeting customer expectations in terms of variety, customization, and convenience.

Regarding the pain points during their experience, the most frequently mentioned issue with vending machine functionalities was the users' frustration when products get stuck. The second most mentioned concern was purchasing expired products, which is problematic because traditional vending machines do not allow for product returns after the purchase. These interview findings form the basis for identifying and validating opportunities for smart vending machines over traditional vending machines, particularly in terms of offering a better consumer experience.

b) Exploratory Study with Company Members

On the other hand, the analysis of interviews with company members aimed to identify potential applications, challenges, and advantages of implementing smart vending machine technology within the organization.

Sumol+Compal operates through various distribution channels, including food retail (supermarkets and convenience stores) and the HORECA channel (hotels, restaurants, and coffee shops). During the interviews, extending the store experience through smart vending machines emerged as a potential service offering for these distribution partners. As one interviewee stated, *"I see a lot of advantages in using these machines as a store complement...“*. This concept involves creating new points of sale that complement existing store setups.

Another application of this technology mentioned in the interviews was its use as a new distribution channel for Sumol+Compal products, such as in metro stations, universities, and other high-traffic locations. One interviewee expressed the potential of this idea by saying, *"Having one of these machines at Oriente Station, and probably there's no space limitation there. As long as there's authorization to place one of these machines..."*

The application of smart vending machine technology in corporate environments has also been mentioned. Several companies, including Sumol+Compal, provide food products to their employees for internal consumption, either through vending machines or refrigerators. One interviewee stated, *"The smart machine will be very helpful because it will effectively identify where the deviations from standard internal consumption come from. People don't respect the limits. Instead of taking one, they take 23 when they shouldn't take more, and that's where I think the smart machine will be very helpful".*

The interview findings also highlight potential challenges and constraints associated with smart vending machine technology. As one interviewee mentioned, *"I think the biggest challenge with these machines is, then, the part of working the data to offer customization."* While this technology enables the generation of valuable data, another interviewee emphasized the importance of utilizing that data by saying, *"What's the use of having so much data if we don't do anything with it? No, it won't add value".*

Converting that data into meaningful insights and effectively managing data sharing can present complexities and require careful attention, as one interviewee pointed out*, "If we think about proposing something like this to Sonae or Pingo Doce, I'm sure they will want their share... And probably even say that they will manage the machine and the data will go back to the Continente card, and you'll only have access to the data through them."*

5.1.4 Conclusions of the Problem Framing

The problem framing phase culminated with the presentation and communication of the findings to the executive board of Sumol+Compal. After careful consideration, it was decided to proceed with the development of a smart vending machine service for corporate environments. Sumol+Compal provides its employees with free access to its products for internal consumption through multiple refrigerators distributed throughout the company. However, several issues related to internal consumption have been identified, including employee dissatisfaction and challenges faced by the team responsible for managing this service. Consequently, this specific use case presents an excellent starting point for exploring the potential of this technology. The controlled environment offered by Sumol+Compal allows

for a more streamlined and manageable service design process. Furthermore, the successful implementation of this use case is anticipated to pave the way for future applications of smart vending machines in other companies. Expanding the service beyond Sumol+Compal's premises and exploring additional use cases, such as store extension, are among the envisioned possibilities.

5.2 Understanding and Mapping of the AS-IS Experience

Once the service to be implemented has been defined, it is crucial to understand and map the AS-IS experience with the internal consumption service at Sumol+Compal.

Exploratory meetings were conducted with 2 key informants with the aim of understanding the actors involved in the internal consumption service and their context. These key informants were selected because they comprehensively view the entire system. They were asked to identify the actors involved in the system, their main functions, and how they are interconnected. After the meetings, it was possible to develop the actor network map (Figure 4), representing all the actors involved.

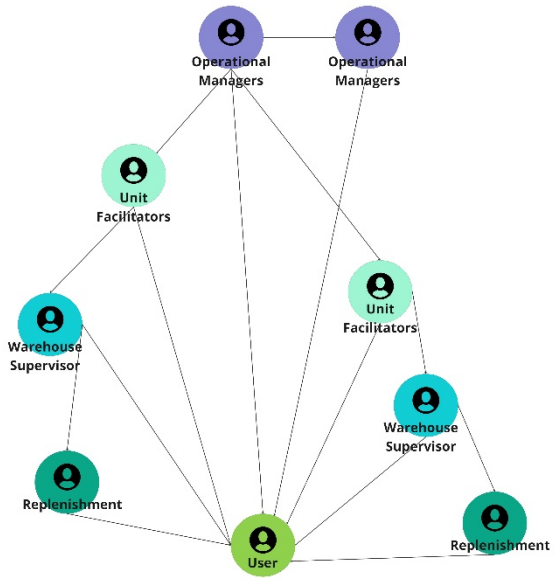


Figure 4 Actor Network Map for Internal Consumption Service

Through the utilization of the actor network map and the data obtained from the exploratory meetings, valuable insights were attained regarding the specific functions and tasks of each role within the service. These findings are summarized in Table 5.

Table 5 Roles Identification and Activities

Roles	Activities
Service users	The service users are the ones who consume the beverages available for internal consumption.
Operational Managers	The role of the operational manager is to ensure that employees have access to beverages for internal consumption, which helps to create a pleasant work environment. These managers are responsible for determining which products are available and overseeing expenses across different company units. They also have the task of defining budgets to ensure that access to beverages is sustainable.
Unit Facilitators	Each headquarters of the company has a unit facilitator who is in charge of managing the orders for beverages to be consumed internally. The facilitators work with the operational managers to ensure that only approved beverages are ordered. They act as a liaison between the operational management and the respective headquarters they are assigned to.
Warehouse Supervisor	The supervisor and facilitator work together at the warehouse to receive orders, prepare shipments, and organize products within the appropriate locations. They are responsible for ensuring that the refrigerators are replenished daily by the Replenishment Team and that the products are arranged properly. The goal is to maintain availability of items in the refrigerators at all times.
Replenishment Team	The Replenishment Team collaborates with the Warehouse Supervisor to guarantee that the refrigerators are adequately supplied. They follow the product placement and organization rules when restocking the display cases each day.

An exploratory study was conducted to gain an in-depth understanding of the experiences of users and service.

An observational study was conducted with 6 employees from Sumol+Compal to gather information about their experiences and suggestions for improvements. Additionally, 5 semi-structured interviews were conducted with service providers, such as operational managers, unit facilitators, and warehouse supervisors. The participants were invited to talk about their goals and frustrations, their daily activities, and the people they interacted with. During the interviews and observational study, notes were taken to aid in data collection. These notes were later categorized and organized on the Miro platform (figure 5).

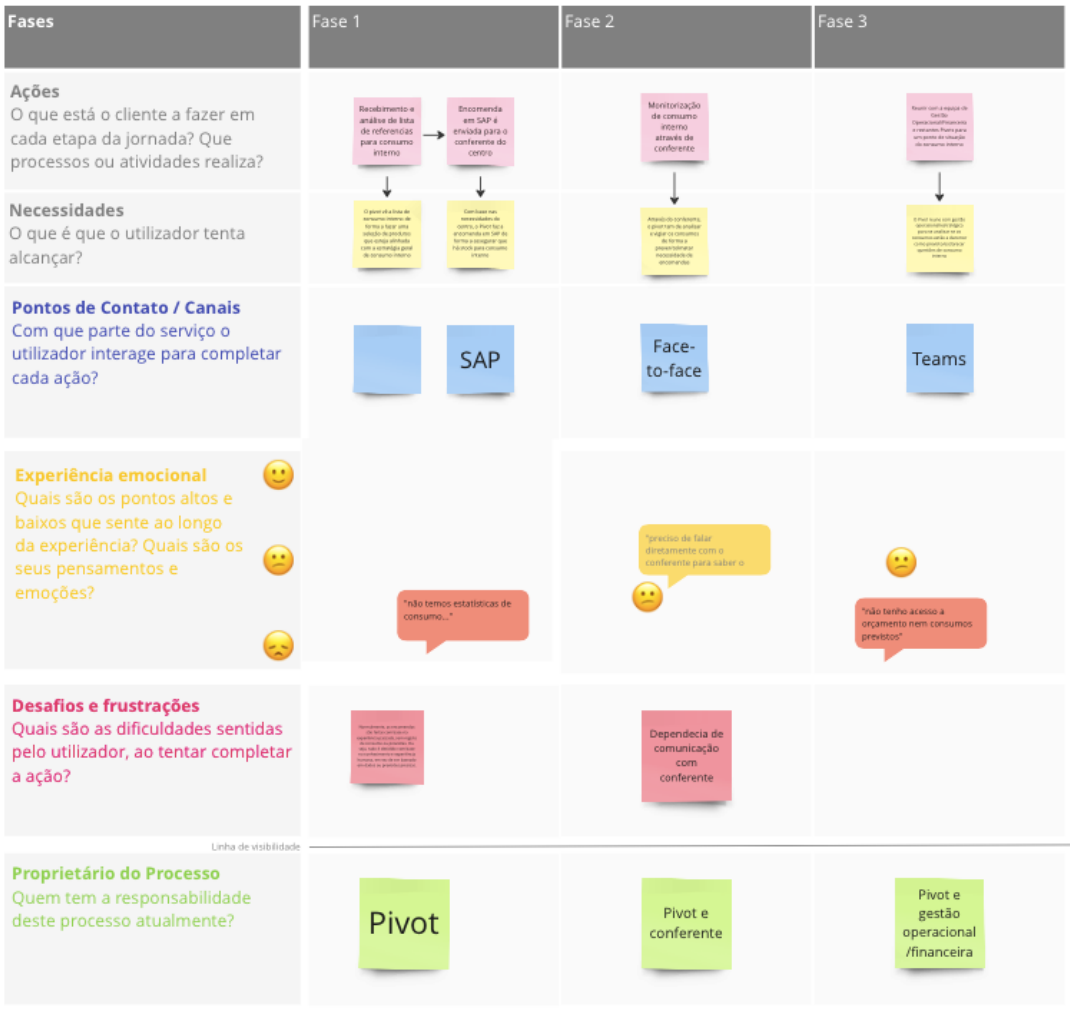


Figure 5 Example of interview categorizing in Miro

To systematize the results obtained from the exploratory study, the SEB (adapted version proposed by the method) was designed, which can be found in figure 5. With the SEB mapping, several pain points were identified as a guide to uncover opportunities during the ideation phase.

One of the major pain points identified in the customer journey is the lack of available stock in refrigerators for internal consumption. Users consistently complain about limited quantities of products and a lack of variety. The fact that each employee has unrestricted access to beverages (unlimited consumption) leads to disproportionate consumption by some employees and external individuals who visit the company but do not have the authorization to consume. Additionally, the location of the refrigerators in less frequented areas of the company is also a source of dissatisfaction.

In terms of backoffice challenges, people perceive that all procedures are heavily dependent on manual work and personal judgment. The communication of internal consumption lists requires email notifications for any changes. Assessing consumption involves downloading order lists

and manually filling out spreadsheets. Product orders are placed when the Warehouse Supervisor identifies low stock levels. The supervisor relies on daily physical counts to verify warehouse stock, particularly for refrigerated items. Unfortunately, when stock is low, it often results in supply shortages.

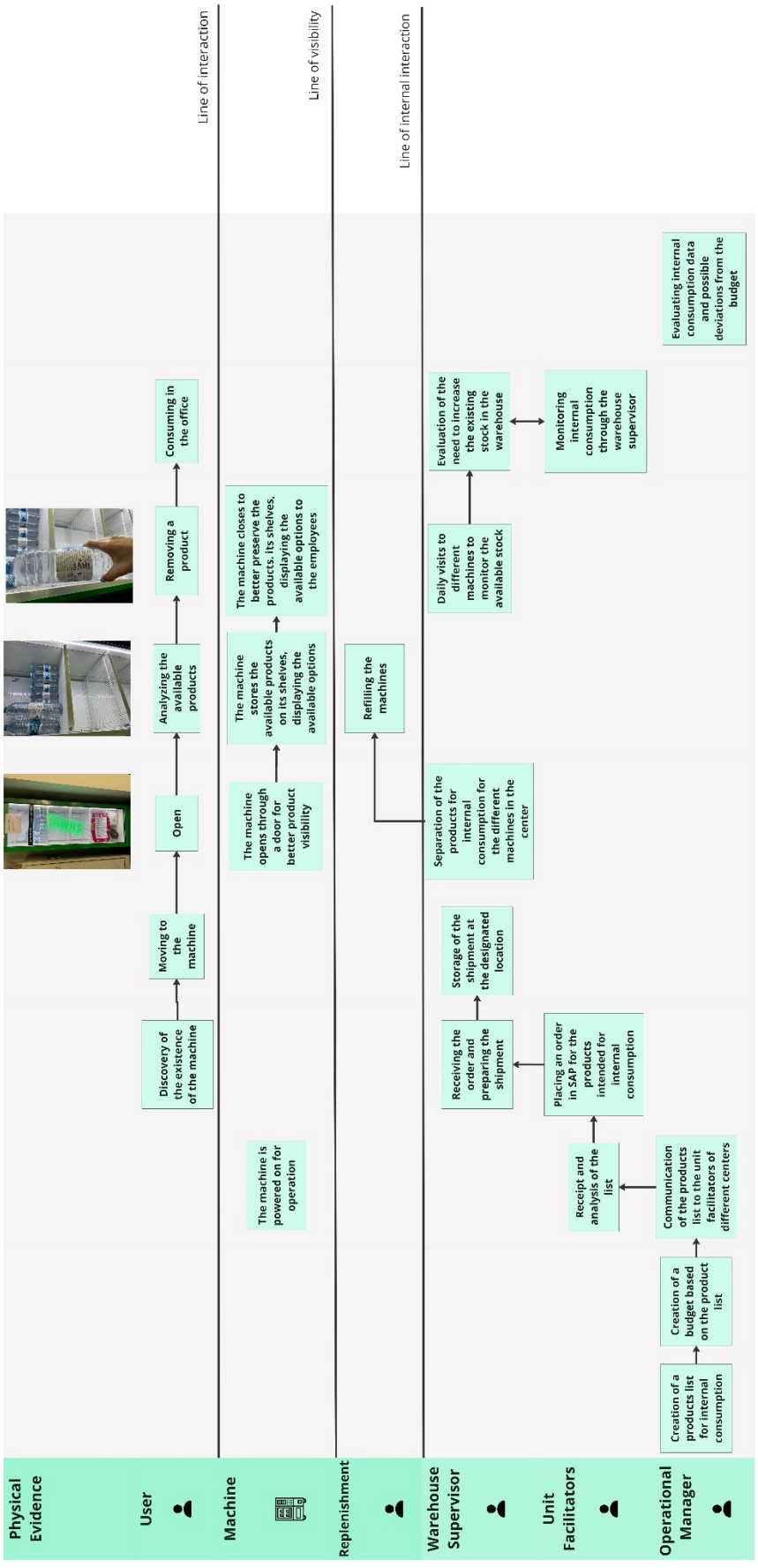


Figure 6 Service Experience Blueprint (AS-IS)

5.3 Ideating and Mapping the TO-BE Process

After mapping the AS-IS experience and identifying pain points, a series of sessions were conducted with key stakeholders, including providers of smart vending machine technology, to explore opportunities and functionalities for the future service.

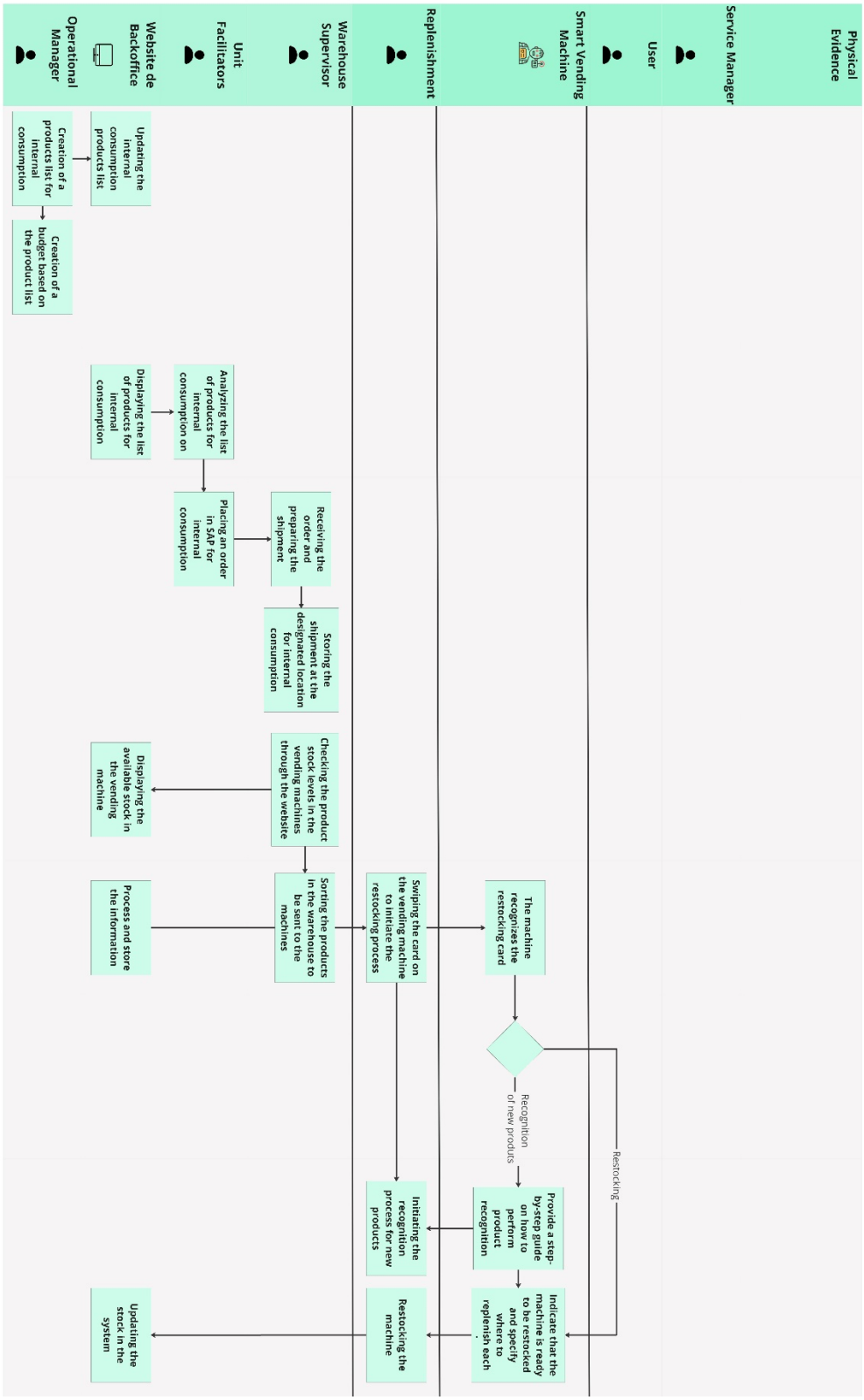
The insights gained from these sessions informed the development of the TO-BE Service Experience Blueprint (Figure 6).

The idealized service encompasses various enhancements to optimize the customer experience. To ensure that only authorized individuals have access to the refrigerator, employee cards will be used. This will prevent any unauthorized consumption and allow for any abnormal consumption patterns to be identified. The implementation of this approach is expected to lead to better stock availability and more efficient consumption management. A new feature has been added to vending machines where users can provide feedback on their experience. During the problem framing phase, it was discovered that users often become frustrated when self-service systems do not provide feedback. To address this issue, vending machines will now feature a QR code that gives users access to a dedicated WhatsApp channel where they can share their feedback on the user experience. In this sense, a new role has emerged, the Service Manager. It is the responsibility of the Service Manager to manage and analyze the tickets generated by customers and ensure that they are resolved.

A website will be created for the back-office to improve communication between service providers. Operational managers can use the platform to create internal beverage lists that will be automatically available to relevant parties. Additionally, notifications will be sent to inform stakeholders of any changes. Leveraging the connectivity and intelligent sensor capabilities of the smart vending machines, real-time data on stock availability will be generated, enabling proactive supply management without the need for manual stock checks. This centralized platform will enable operations managers to accurately track beverage consumption, leading to more efficient budget management. By consolidating all relevant information in one location, the need for email communication to obtain such data will be eliminated. Furthermore, the replenishment team will benefit from automated notifications regarding stock levels, allowing them to prioritize their tasks effectively. One of the significant advantages offered by these machines is the ability to create personalized experiences for consumers.

A new position has been created to analyze data from smart vending machines. The role involves identifying patterns and opportunities to enhance marketing strategies and improve customer experiences. Through the problem framing phase, it was clear that users want personalized experiences, which the TO-BE service aims to incorporate in the future. However,

given that we are designing a service from scratch with this technology, customization may not be feasible in this initial phase. It is important to bear in mind that the service is being designed with a minimum viable product (MVP) approach. As the user base grows, the service will be improved based on feedback and user preferences. While complete customization may not be possible initially, the focus is on continuous learning and adaptation to create a more personalized experience as the service evolves. This iterative process ensures a refined and enhanced experience for users.


Physical Evidence
Service Manager
User
Smart Vending Machine
Replenishment
Warehouse Supervisor
Unit Facilitators
Website de Backoffice
Operational Manager
Creation of a products list for internal consumption
Updating the internal consumption products list
Creation of a budget based on the product list
Analyzing the list of products for internal consumption on
Displaying the list of products for internal consumption
Placing an order in SAP for internal consumption
Receiving the order and preparing the shipment
Storing the shipment at the designated location for internal consumption
Checking the product stock levels in the vending machines through the website
Displaying the available stock in the vending machine
Sorting the products in the warehouse to be sent to the machines
Process and store the information
Swiping the card on the vending machine to initiate the restocking process
The machine recognizes the restocking card
Recognition of new products
Restocking
Provide a step-by-step guide on how to perform product recognition
Initiating the recognition process for new products
Indicate that the machine is ready to be restocked and specify where to replenish each
Restocking the machine
Updating the stock in the system

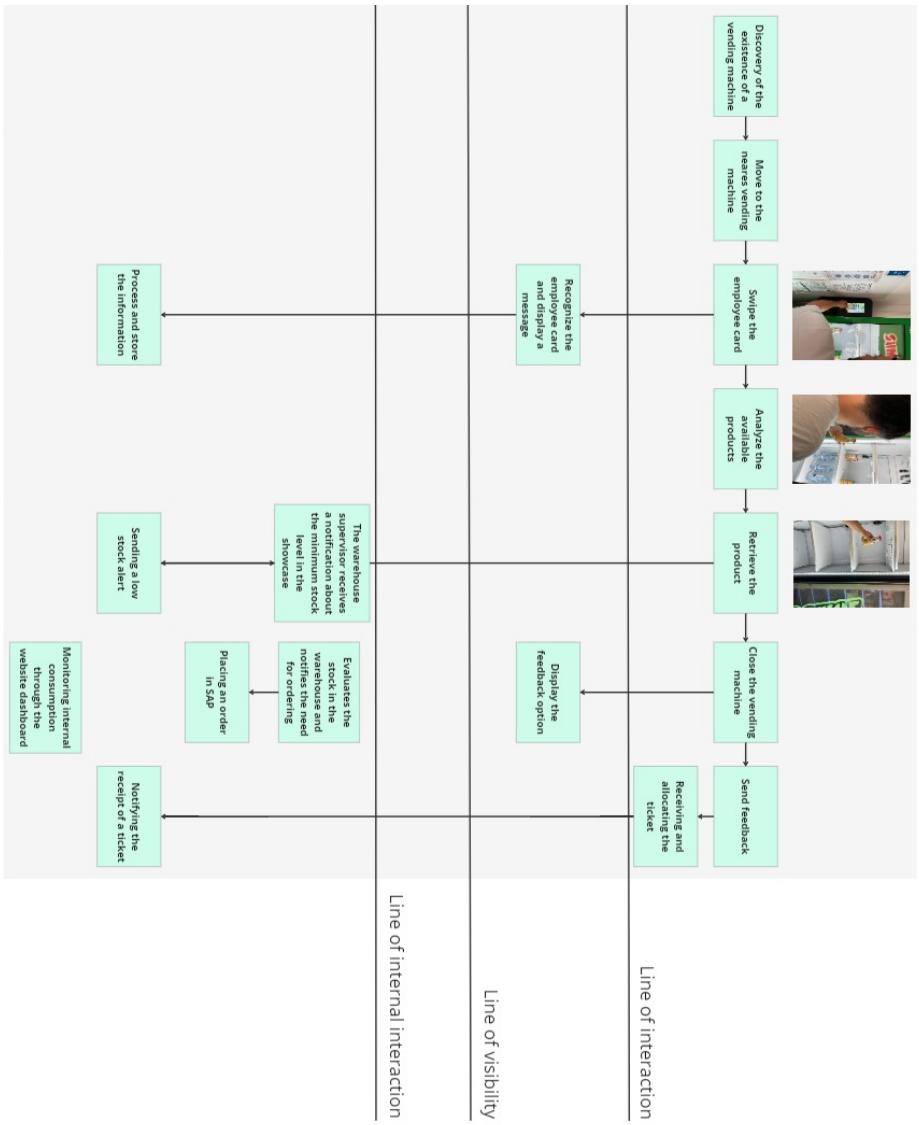


Figure 7 Service Experience Blueprint (TO-BE)

5.4 Prototyping and Testing

After defining the TO-BE service, it was crucial to subject it to comprehensive testing, considering not only the end user experience but also the experience of all actors involved in the service delivery process. With this objective in mind, eight interfaces were developed, covering both the back-office website and the smart vending machine screen (APPENDIX D). However, it is important to note that the focus of these interfaces was not limited to individual testing but rather evaluating the interaction of all actors with the service. To achieve this holistic approach, a workshop was conducted involving five participants representing both the future users of the service and the service providers. The main purpose of this workshop was to identify potential challenges and improvements to be implemented in the future service. Additionally, it aimed to foster collective collaboration to enhance the service comprehensively.

The workshop was conducted in well-defined stages. Initially, an introductory presentation was given to clarify the session's objectives and present the different interfaces developed. Then, participants were invited to assume the roles of the various actors involved in the service delivery process and interact with the available interfaces (Figure 7 and Figure 8). It is important to emphasize that even though the smart vending machine was not fully functional at this stage, it was used as support to simulate the complete experience for all actors involved.

Figure 8 Test and discussion of the prototypes

After individually exploring the interfaces, participants write in post-its the challenges encountered and the positive aspects identified during their interaction with the service on post-it notes. This was followed by a sharing and group discussion phase, promoting a brainstorming session to enhance and refine the service to be implemented (Figure 9).

Figure 9 Testing the process of getting a drink from the Smart Vending Machine

This comprehensive approach of testing the service, focusing on the experience of all actors involved, allowing for a comprehensive evaluation, identifying challenges, and improvement opportunities, and enhancing the overall TO-BE service experience for everyone involved.

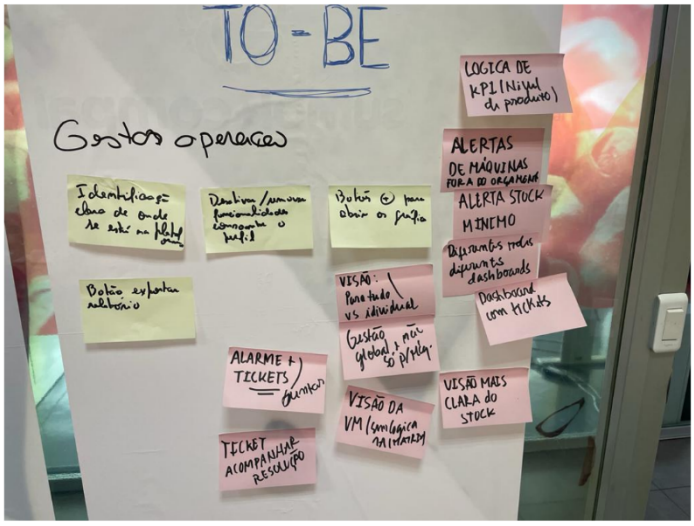


Figure 10 Discussion and brainstorming of the service TO-BE

The workshop yielded valuable insights and conclusions about the TO-BE service, highlighting significant findings. During a group discussion, it was noted that requiring employees to swipe their card to access the vending machine was viewed favorably as it could promote fairness within the organization. Participants appreciated the machine's recognition of their names but suggested an interactive screen displaying company news and product launches would enhance their experience. Concerns were raised about the machine's glass door locking and users accidentally selecting the wrong product, highlighting the need for a secure and user-friendly interface.

Participants in the back-office management expressed their desire for a customizable website that caters to individual roles. They emphasized the importance of allowing users to define their preferred dashboard, receive relevant notifications, and set up alerts according to their specific needs. This customization feature was seen to empower users and enhance their efficiency in managing the service. Participants also preferred accessing the back-office through both the website and smartphones to make it more convenient. The ability to export reports directly from the website was also deemed essential for users as it enables them to generate and analyze reports for better insights and informed decision-making.

Conclusion and Future Research

In conclusion, this study successfully achieved its primary objective of developing a comprehensive method for AI-enabled self-service design, effectively addressing a significant research gap identified in the existing literature. The created method represents a valuable contribution to the field of service design research, introducing an innovative approach that has been tested and validated in a real-world organizational environment. Its applicability and effectiveness have been demonstrated, offering practical guidelines for implementing AI-enabled self-service initiatives.

An important milestone in the research process was successfully testing the method up to the prototyping stage in a real-world context. Regrettably, it was not possible to monitor the implementation phase within the allotted timeframe. However, the training process has already started and the implementation of the service in one of the Sumol+Compal offices is scheduled for July 2023. The implementation phase takes into account the feedback received during the prototyping phase. It is crucial to recognize that the dynamic and ever-changing nature of AI technology requires continual tuning and improvement during the implementation phase in order to achieve optimal performance and user experience.

In addition, this research proposed an adaptation of the Service Experience Blueprint (SEB) to encompass and analyze all the involved journeys associated with the service. By incorporating the experiences of the key actors involved in the service delivery process, a holistic understanding of the implications and impact of AI-enabled automation on the overall service experience was achieved. Applying the adapted SEB in a real-world organizational context has validated its usefulness and effectiveness, emphasizing that comprehensive mapping of behind-the-scenes journeys is crucial to facilitating an enhanced end-user experience.

Although the developed method has been validated in the food and beverage industry, it is imperative that future research expand the applicability and generalization of the method in different business contexts. In addition, the next phase of implementation will provide valuable insight into the practical challenges and opportunities inherent in deploying AI-enabled self-service solutions.

The insights gained from this study lay a solid foundation for future research efforts, enabling the advancement of AI-enabled self-service design methodologies. Ultimately, integrating AI into self-service systems has the potential to revolutionize customer experiences, improve operational efficiency and drive organizational growth.

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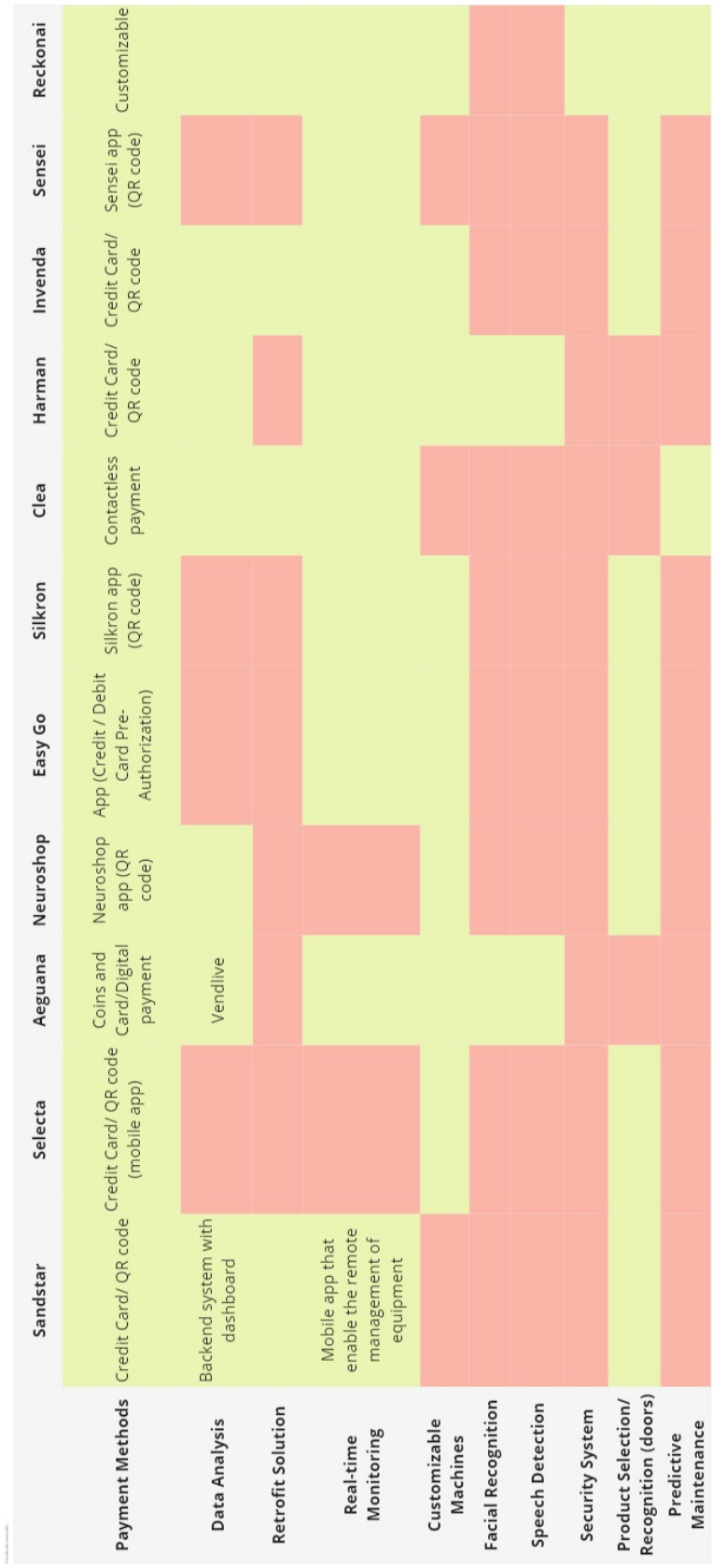
APPENDIX A: Benchmarking



APPENDIX B: Interview Protocol

Target

In order to understand the potential of smart vending machines for Sumol+Compal, exploratory interviews will be carried out with different stakeholders:

- Traditional Vending Machine Users
- Food Channel Managers
- Horeca Channel Managers
- Human Resources
- Marketing and Data Management

Goals

The interviews aim to:

- Understand the current consumer experience with traditional vending machines
- Identify pain points in the current experience
- Understanding the potential of using Smart Vending Machines for Sumol+Compal
- Explore the potential of using Smart Vending Machines in the partner network (food channel/horeca)
- Explore the impact of smart vending machines on S+C's performance at the logistic/stock management level

Logistical aspects

- Identify all participants for these interviews, scheduling convenient dates/times
- Interview sessions can be conducted in person or remotely (via Teams)
- Get access to record interviews.
- Interviews are expected to last 60-90 minutes.
- With participants' approval, sessions will be recorded to help with note-taking and data analysis.
- The questions are intended to be a guide to the discussion, and their order may vary based on the flow of conversation and new areas of exploration that may arise.

Protocol | Consumers

Introduction/Presentation

Good morning/Good afternoon [participant name]. My name is Madalena Cunha and I am an intern in the TD department at S+C.

We are exploring the possibility of implementing Smart Vending Machines at S+C. Smart Vending Machines are internet-connected vending machines that use Artificial Intelligence technology.

Before we begin, I would like you to be aware of the following important points:

- There are no right or wrong answers. I am genuinely interested in knowing, as much as possible, the experiences you had, in the 1st person.
- All information collected during this session will be later anonymized during its analysis phase and presented in aggregated form. At no time will we use data or information that can be linked to you.
- We intend to record our session so that it is easier to take notes and review in the analysis. Recordings will not be shared and will be destroyed upon review. So, would you like to ask your permission?

[If authorized, START RECORDING]

[If you do not authorize] We understand, no problem. We'll do our best to take notes.

Any questions before we start?

[Introductory Questions] Background & Role

Just to start, let's understand a little better the nature of your work

Tell me a little about yourself.

[Exploratory Questions] Current State Validation

- Have you used a vending machine in the past?
- How often do you do it? And in which places/contexts?
- What do you usually buy in vending machines?
- Do you usually shop alone or accompanied?

- If you answered accompanied, did the presence of other people influence your decision?

[Development] Pain Points and Opportunities

- What do you like most and what do you most value in a vending machine?
- What do you least like about using vending machines?
- Can you describe a less good situation? What did you do in this situation?
- Are there products that you would like to have available in vending machines that you normally cannot find?
- When you can't find the product you were looking for in a vending machine, do you give up on your purchase? Or are you looking for an alternative product?
- What payment method do you use?
- Do you find the payment process easy and fast? Would it change anything?
- Would you like to have other “features” available?
- Is there any place/places where you would like to have the option to buy products through vending machines?
- Can you describe what the ideal vending machine would look like? (In a world where anything would be possible)

Conclusion

Thank you very much for your availability. In addition to what you have already mentioned, is there anything else you would like to make? Thanks again and have a great day.

Protocol | Data Management

Introduction/Presentation

Good morning/Good afternoon [participant name]. My name is Madalena Cunha and I am an intern in the TD department at S+C.

We are exploring the possibility of implementing Smart Vending Machines at S+C. Smart Vending Machines are internet-connected vending machines that use Artificial Intelligence technology.

Before we begin, I would like you to be aware of the following important points:

- There are no right or wrong answers. I am genuinely interested in knowing, as much as possible, the experiences you had, in the 1st person.
- All information collected during this session will be later anonymized during its analysis phase and presented in aggregated form. At no time will we use data or information that can be linked to you.
- We intend to record our session so that it is easier to take notes and review in the analysis. Recordings will not be shared and will be destroyed upon review. So, would you like to ask your permission?

[If authorized, START RECORDING]

[If you do not authorize] We understand, no problem. We'll do our best to take notes.

Any questions before we start?

[Introductory Questions] Background & Role

Just to start, let's understand a little better the nature of your work

Tell me a little about yourself.

[Exploratory Questions] Current State Validation

- How does S+C currently collect customer data?
- What data do they collect about customers?
- What do you do with that data?
- What data is most important to collect about consumers?
- Does S+C share this data with partners?

[Development] Pain Points and Opportunities

- What are the biggest challenges that S+C has in collecting consumer data?
- Are you aware of the concept of smart vending machines?
- How could the use of this technology benefit data collection?
- What are the associated challenges?

Conclusion

We asked all the questions we had for you today. Thank you very much for your availability. In addition to what you have already mentioned, is there anything else you would like to make? Thanks again and have a great day

Protocol | Organizational Management

Introduction/Presentation

Good morning/Good afternoon [participant name]. My name is Madalena Cunha and I am an intern in the TD department at S+C.

We are exploring the possibility of implementing Smart Vending Machines at S+C. Smart Vending Machines are internet-connected vending machines that use Artificial Intelligence technology.

Before we begin, I would like you to be aware of the following important points:

- There are no right or wrong answers. I am genuinely interested in knowing, as much as possible, the experiences you had, in the 1st person.
- All information collected during this session will be later anonymized during its analysis phase and presented in aggregated form. At no time will we use data or information that can be linked to you.
- We intend to record our session so that it is easier to take notes and review in the analysis. Recordings will not be shared and will be destroyed upon review. So, would you like to ask your permission?

[If authorized, START RECORDING]

[If you do not authorize] We understand, no problem. We'll do our best to take notes.

Any questions before we start?

[Introductory Questions] Background & Role

Just to start, let's understand a little better the nature of your work

Tell us a little about yourself.

[Exploratory Questions] Current State Validation

- Currently, how does your S+C make its products available to employees?
- What is the average consumption in the different offices?

- How is the selection of available products made?

[Development] Pain Points and Opportunities

- What are the biggest challenges that S+C faces with the current way of making products available to employees?
- Are you aware of the concept of smart vending machines?
- What benefits do you see from replacing traditional vending machines with smart vending machines?
- What are the challenges associated with using this new technology internally?
- How do you think the employee experience could be affected?

Conclusion

We asked all the questions we had for you today. Thank you very much for your availability. In addition to what you have already mentioned, is there anything else you would like to make? Thanks again and have a great day.

Protocol | commercials

Introduction/Presentation

Good morning/Good afternoon [participant name]. My name is Madalena Cunha and I am an intern in the TD department at S+C.

We are exploring the possibility of implementing Smart Vending Machines at S+C. Smart Vending Machines are internet-connected vending machines that use Artificial Intelligence technology.

Before we begin, I would like you to be aware of the following important points:

- There are no right or wrong answers. I am genuinely interested in knowing, as much as possible, the experiences you had, in the 1st person.
- All information collected during this session will be later anonymized during its analysis phase and presented in aggregated form. At no time will we use data or information that can be linked to you.
- We intend to record our session so that it is easier to take notes and review in the analysis. Recordings will not be shared and will be destroyed upon review. So, would you like to ask your permission?

[If authorized, START RECORDING]

[If you do not authorize] We understand, no problem. We'll do our best to take notes.

Any questions before we start?

[Introductory Questions] Background & Role

Just to start, let's understand a little better the nature of your work

Tell me a little about yourself.

Exploratory questions

- What are the biggest challenges that S+C has in selling products through different distribution channels?
- What are the main criticisms/challenges that partners communicate to you regarding the sale of S+C products?
- Are you familiar with the concept of Smart Vending Machine?
- What do you think about using Smart Vending Machines to sell S+C products?
- What advantages and disadvantages do you see?
- In which distribution channels do you think it would be most beneficial to use Smart Vending Machines?
- How do you think the introduction of SVM can affect the relationships with the partner network?
- What data would be relevant to collect?

Conclusion

We asked all the questions we had for you today. Thank you very much for your availability. In addition to what you have already mentioned, is there anything else you would like to make? Thanks again and have a great day.

Protocol | Food Channel and Horeca

Introduction/Presentation

Good morning/Good afternoon [participant name]. My name is Madalena Cunha and I am an intern in the TD department at S+C.

We are exploring the possibility of implementing Smart Vending Machines at S+C. Smart Vending Machines are internet-connected vending machines that use Artificial Intelligence technology.

Before we begin, I would like you to be aware of the following important points:

- There are no right or wrong answers. I am genuinely interested in knowing, as much as possible, the experiences you had, in the 1st person.
- All information collected during this session will be later anonymized during its analysis phase and presented in aggregated form. At no time will we use data or information that can be linked to you.
- We intend to record our session so that it is easier to take notes and review in the analysis. Recordings will not be shared and will be destroyed upon review. So, would you like to ask your permission?

[If authorized, START RECORDING]

[If you do not authorize] We understand, no problem. We'll do our best to take notes.

Any questions before we start?

[Introductory Questions] Background & Role

Just to start, let's understand a little better the nature of your work

Tell me a little about yourself.

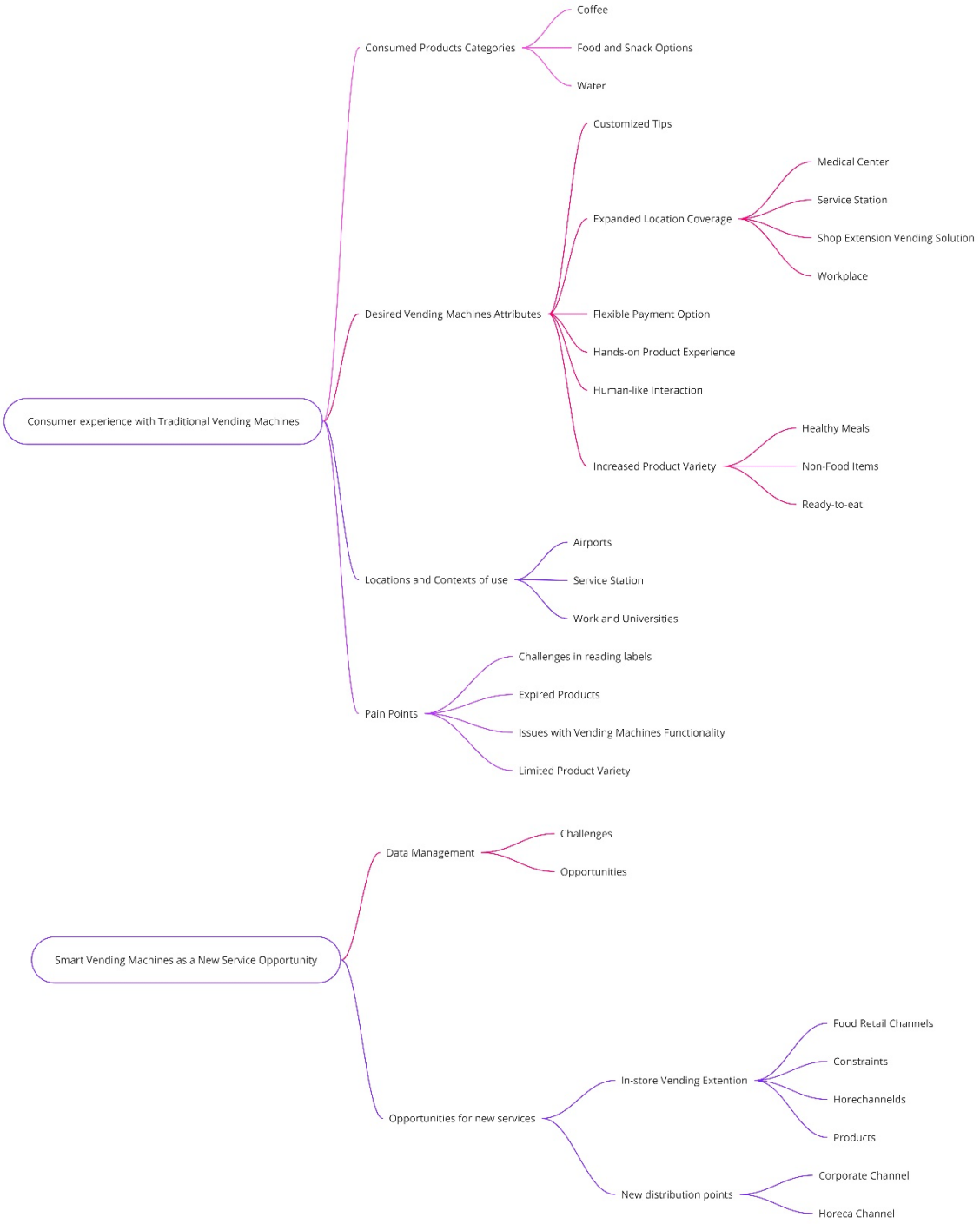
Exploratory Questions

- How do you currently sell S+C products?
- How do you manage the stock of S+C products? What are the associated challenges?
- Are you aware of the Smart Vending Machines concept?
- Do you think your customers would be interested in buying S+C products through Smart Vending Machines?
- How do you manage in-store orders at peak times?
- What opportunities do you see with using SVM?
- And challenges?

Conclusion

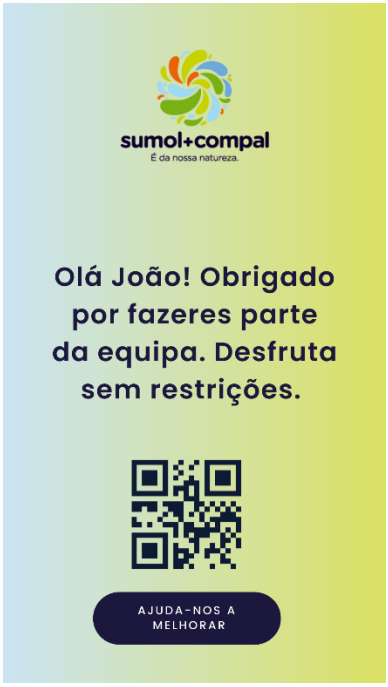
We asked all the questions we had for you today. Thank you very much for your availability. In addition to what you have already mentioned, is there anything else you would like to make? Thanks again and have a great day.

APPENDIX C: Interview Codes in NVivo



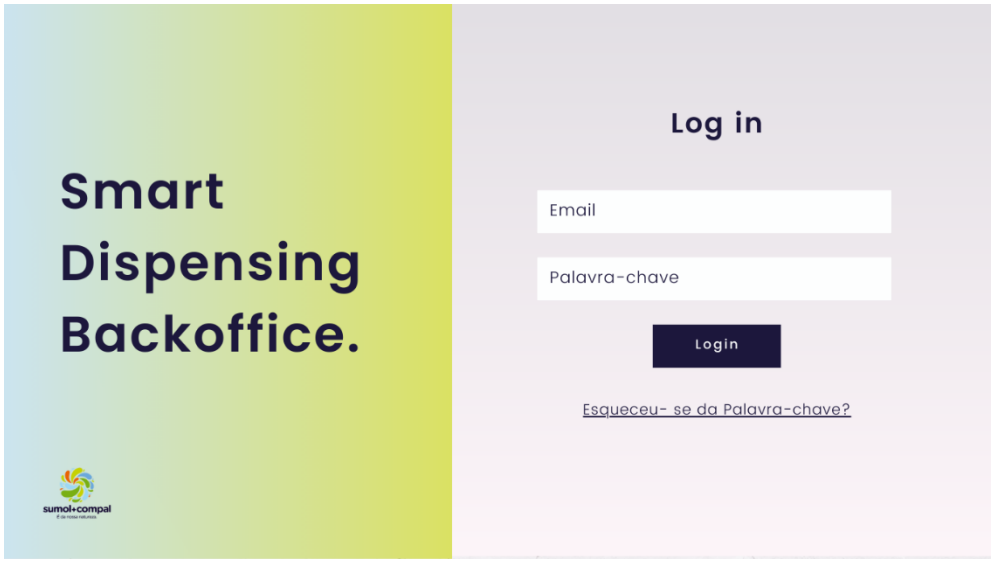
APPENDIX D: Prototypes

Vending Machine Screens:



Vending machine screens for restocking:

Backoffice Website:




sumol+compal
DASHBOARD
PRODUTOS
TICKETS
LOGOUT
Machine A2- Póvoa de Varzim
Tickets
TICKET NUMBER
DATA
STATUS
RESPONSÁVEL
A6FHDY
6/6/2023
JOÃO MOREIRA
A6FHDY
6/6/2023
JOÃO MOREIRA
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