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# Technological advancements in the retail industry: Perceptions and preferences of Portuguese consumers regarding supermarket brands and checkout methods

TE THE EXPLANATION OF THE MYSTERY SHOPPING EXPERIENCE AND THE SURVEY DESIGN OF PERCEPTUAL MAPPING

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**Abstract**

Self-Service Technologies (SSTs) have emerged as a strategy for retailers to improve customer experience. This research determines Portuguese consumers' supermarket brand perceptions, to understand what players occupy an advantageous mental space for the implementation of these technologies: Perceptual Mapping. Findings reveal that the relationship between consumers and supermarkets is predominantly transactional, therefore perceptions of individual hedonic values are incomputable. Moreover, a Conjoint Analysis was employed to analyze preferences in checkout methods. While consumers under 45 are very interested in checkout-free technology, they exhibit a low willingness to pay for these technologies. Current market players can improve their checkout-free store models.

**Keywords:** Marketing Research, Self-Service Technologies (SSTs), Checkout Methods, Checkout-free Technology, Mystery Shopping, Perceptual Mapping, Brand Perceptions, Conjoint Analysis.

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**List of Abbreviations**

SST: Self-Service Technology

SCO: Self-Checkout

TAM: Technology Acceptance Model

RFID: Radio Frequency Identification

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## 1. Introduction

As consumer activity continues to shift from offline to online, the retail industry has undergone dramatic changes in the last decade. The Covid-19 pandemic boosted many technological trends, leaving retailers looking for new strategies to improve the customer experience and drive traffic back to the store (McKinsey & Company, 2022).

While a healthy tech foundation can give retailers the competencies to improve overall performance, most companies have not made sufficient progress and are missing opportunities as a result. In fact, suggestive evidence has shown that, between 2016 and 2020, digital leaders in the retail industry generated 3.3 times the total returns to shareholders of digital laggards (McKinsey & Company, 2021).

Retailers have been adapting a customer journey approach, in order to identify and address the most relevant consumer pain points. Accordingly, checkout-free technology in retail has emerged as the key to the creation of a frictionless customer experience. This process has often been dubbed "cashier-less checkout" but is more accurately described in the industry by "checkout-free technology", given that the entire checkout process is eliminated. "*Checkout-free/unmanned store is a new retailing concept where customers check in with mobile apps, choose their goods, and leave the store without help from cashiers or machines. In an ideal setting, it would be a complete automatic shopping experience for the time-scarce consumers, and an effective way to save manpower costs for retailers*" (Qi, 2019). This concept first caught the attention of Amazon, who announced their Just Walk Out technology in 2016: "*it allows consumers to shop as they normally would but save time and effort by eliminating the checkout—meaning no lines, no scanning products, and no fuss*" (AWS, 2022). To process transactions,

invoices, and billing, checkout-free technology makes use of QR codes, smart shopping carts, RFID (radio-frequency identification) tags, and machine vision (AI Multiple, 2022).

Such technologies combine convenience with experience. By allowing consumers to simply walk out of a store, retailers are directly eliminating the largest consumer pain point. In fact, "*25% of consumers are likely to avoid entering stores with long wait times, which may cause retailers to lose up to $100 billion annually"* (Qudini, 2020). Moreover, these technologies add value to retailers in additional ways, by implementing a new medium to understand customer behaviors and deliver more personalized messaging, improving inventory management, and replacing the traditional brick-and-mortar model with a modern experience. (A&M, 2022). Nonetheless, widespread adoption by consumers is still a relevant obstacle.

Checkout-free technology falls under the definition of self-service technology (SST). SSTs can be defined as "*technological interfaces that enable customers to produce a service independent of direct service employee involvement*" (Meuter et al., 2000). SSTs began being adopted in the 1990s, in the United States, but have since exponentially become the norm (Rinta-Kahila et al., 2021). These technologies have ultimately changed the expectations of customers since the role of the store employee has been replaced by technology (Hilton et al., 2013). Among the many different SSTs available, self-checkout (SCO) lanes have become an extremely popular choice for supermarkets around the world. Interestingly, a 2022 study found that SCOs currently comprise nearly 40% of lanes in US supermarkets. (Catalina, 2022). In 2019, the SST market size was valued at USD 28.3 billion, and is predicted to register a compound annual growth rate (CAGR) of 6.7% from 2020 to 2027 (GVR, 2020).

According to a financial literacy study conducted in 2016, 39% of Portuguese consumers claim to use the SSTs available in commercial spaces (Sapo, 2016). In recent years, Portugal has

pioneered innovation within the supermarket retail sector through the opening of two stores implementing checkout-free technology. In 2019, Portuguese retail group Jerónimo Martins launched the Pingo Doce & Go Lab Store, located at the Nova SBE campus. The pilot store addresses the specific needs of university students, "*offering a quick and convenient shopping experience*" (ESM, 2019). In 2021, Portuguese retailer Sonae partnered with Sensei, the leading European provider of autonomous stores, to launch Continente Labs. Because of the more advanced technology of Continente Labs, this store was the first in Europe to challenge Amazon's dominance in the market space (Charged, 2021).

Before the Covid-19 pandemic, Portugal was enjoying an overall positive economic climate. The country was considered one of Europe's most promising food markets, with projections indicating a compound annual growth rate (CAGR) of 2.2% from 2019 through 2022 (Dunnhumby 2021). As of 2021, trends in consumer behavior reported that Portuguese customers have been "*increasingly seeking promotions and discounts*" and limiting their "*food expenditures in response to COVID-19"* (GAIN, 2021). In fact, the discount distribution chain Lidl was one of the only food retail brands to gain market share in terms of value in 2020 (DN, 2020). Nonetheless, the expansion of the discounter model that has been registered throughout Europe is hampered by Portugal's unique retail industry. Unlike most European countries, the market "*is dominated by a small number of large retailers that specialize in traditional offerings*" (Dunnhumby, 2021). In terms of market share, the sector has been historically led by two national players: Sonae, with Continente (26.8%), and Jerónimo Martins, with Pingo Doce (22.9%) – accounting approximately for 50% of the retail market (GAIN, 2021). The present Work Project will focus on the top five supermarket brands based on their most recent turnover values, in Portugal. Therefore, alongside Continente and Pingo Doce, the following brands will

be the target of analysis: LIDL, with an 11.3% market share value; Auchan, with 5.6%; Minipreço, with 3.9% (GAIN, 2021).

This dissertation narrows the object of study to the supermarket retail sector in Portugal, with two main purposes. First, the goal is to understand the perceptions of Portuguese consumers regarding supermarket brands operating in the national market, and how the mental space that a brand occupies in Portuguese consumers' minds can impact its chances of success when investing in checkout-free technology. These findings will be of value to industry players evaluating the possibility of implementing this process in their stores, given the lack of literature on the matter. Secondly, the focus will shift to what attributes of checkout methods, mainly checkout-free technology, are most valued by Portuguese consumers, alongside their willingness to pay for these services. Accordingly, the following research questions are proposed: **RQ1)** How do Portuguese consumers perceive supermarket brands operating in the national market? **RQ2)** What are the attributes that Portuguese consumers value the most in supermarket checkout methods?

Furthermore, the growing competition between supermarket brands increases the need for a deeper understanding of what criteria influence consumers' brand choices. Dongdae Lee & Michael Hyman (2008) found that consumers' choice of a product or store is driven by both hedonic and functional considerations. Thus, to determine what factors predominantly lead consumers to visit supermarket stores, a third research question is proposed, complementing the first one: **RQ3**) What are the drivers influencing what supermarket stores consumers choose to visit?

In addition, it is important to address the two opposing tendencies at play in the Portuguese market. Although SSTs are evidently growing in popularity, their success is highly influenced by "*customer's engagement, knowledge, behavior, and skills to complete the transactions*"

(Kara & Orel, 2014). Simultaneously, in 2021, the elderly population (65 and older) represented 23,4% of the total population in Portugal (INE, 2021). Customer age is a factor of particular importance that affects the interest in SSTs, due to the positive correlation between older age groups and technological illiteracy and anxiety. In other words, older people are more apprehensive to use SSTs because of the expected difficulties of learning new tasks (Simon & Usunier, 2007). Therefore, a fourth research question is proposed to complement the second one: **RQ4)** How does the age factor impact Portuguese consumers' interest in checkout-free technology?

In order to answer these questions, a literature review guided the research and served as background for the consumer and expert interviews conducted, as well as for the mystery shopping experience organized and built around the Technology Acceptance Model (Davis & Warshaw, 1989). These steps provided crucial insights for the careful development of a methodology based on two analyses: the construction of a Perceptual Map, based on the Brand Personality Construct (Aaker, 1997); and the development of a Conjoint Analysis. Data was collected, analyzed, and discussed. Finally, a conclusion summarized the major findings, together with highlighting some limitations and recommendations for future studies on the topic.

## 2. Major Findings

This section of the dissertation explores the major research findings provided by all qualitative, quantitative, and mixed methods applied, which will later be analyzed in detail. The development of a perceptual map aimed at examining how Portuguese consumers perceive supermarket brands, accessing RQ1. Contrary to what was expected, even though supermarket brands are

perceived quite distinctively from one another, consumers do not perceive brands multidimensionally through individual hedonic values. Brands are perceived by means of a unidimensional construct of perceived quality. Moreover, the way in which consumers perceive brand quality is directly affected by how often they visit a supermarket brand. This leads to the conclusion that the relationship between supermarket brands and Portuguese consumers is transitional, rather than hedonic, answering RQ3. When analyzing Portuguese consumers' most valued checkout methods and their respective attributes - RQ2 -, willingness to pay was revealed to be a decisive factor. Portuguese consumers are extremely price-sensitive to potential checkout services' prices, however, willingness to pay does increase proportionally with technology level. Age was revealed to be a key factor in SSTs adoption, addressing RQ4. Checkout-free technology stands out as the favorite checkout method for consumers under 45, and cashier lanes are the preferred method for consumers over 45. As expected, younger consumers tend to have an easier time operating with these technologies and assign them more value. Simulations revealed no significant differences in preference between the store models of Continente Labs and Pingo Doce & Go Nova but addressed potential model adaptation to maximize preference share.

## 3. Work Project Design

The current dissertation was organized into four stages, as seen in Figure 1.

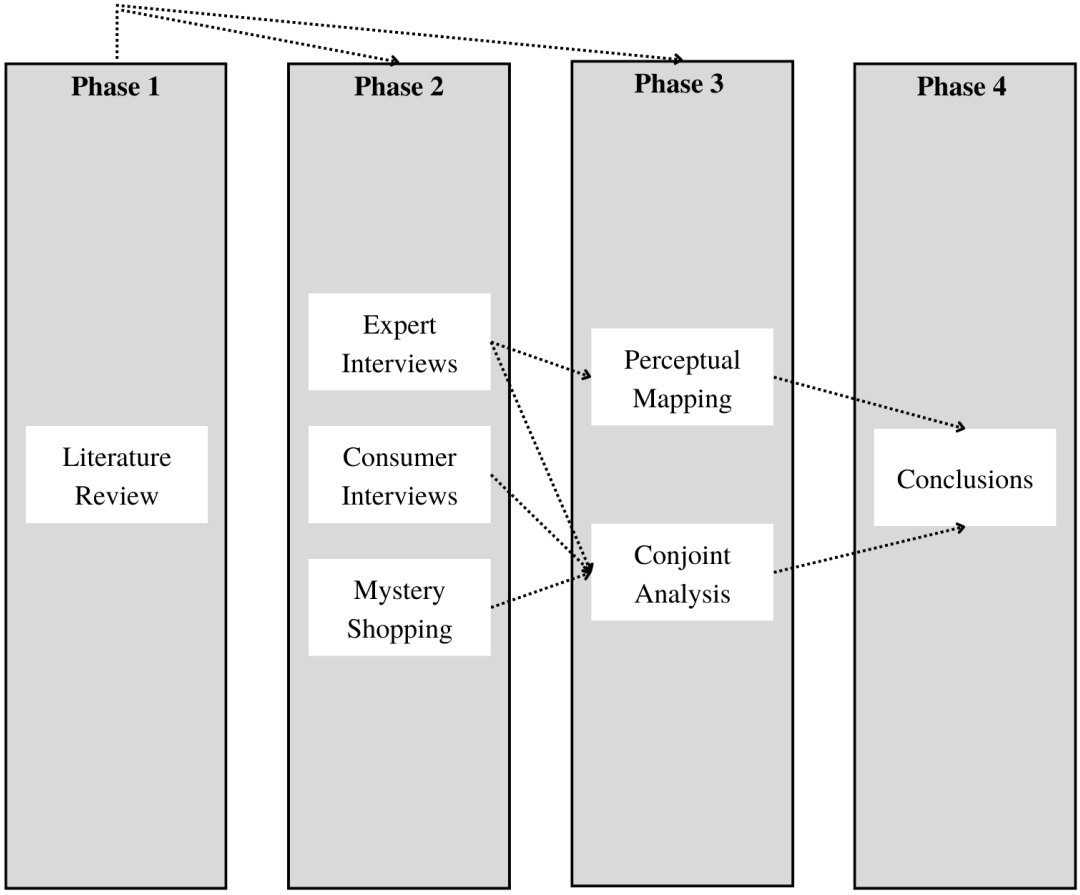


*Figure 1: Work Project Design Diagram*

**Phase 1**, the Literature Review, consisted of the study of the existent literature on the topic of SSTs, largely centered on the concept of checkout-free technology, and on the planned analyses (Perceptual Mapping and Conjoint Analysis). Subsequently, **Phase 2** involved qualitative and quantitative methods of research, through contact with consumers (interviews and mystery shopping experience) and industry experts (interviews). Findings from the Literature Review supported this stage of the project, by offering clear insights for the development of interview scripts, as well as briefs for the mystery shoppers. **Phase 3** comprised the two principal analyses

of the Work Project: perceptual mapping and conjoint analysis. The Literature Review conducted on these methods of analysis - mainly the existing studies applied to the topic of SSTs -, offered clear guidelines for their design, construction, and application. Findings from Phase 2 were used for the development of these analyses: expert interviews supported both the perceptual mapping and the conjoint analysis, while consumers (interviewees and mystery shoppers) only offered insights for the latter. Finally, **Phase 4** consisted of the extraction of the main conclusions of the analyses (Phase 3), a statement of project limitations, and the development of recommendations for future studies on the topic.

## 4. Literature Review

Technology Acceptance Model

### *a. Technology Avoidance*

Whilst organizations continue to introduce new technologies, the challenge of widespread consumer adoption remains relevant. In fact, "*for as long as technology has existed, people have resisted it*" (Dziak, 2020). The reasons why certain consumers actively avoid new technologies vary, however, the main thought trends and attitudes that hamper the acceptance of technology are the following: (i) technology creates higher unemployment; (ii) technology dehumanizes goods and services, by reducing personal touch; (iii) it is difficult to learn how to use new technologies (Dziak, 2020). These ideas are strongly present in the discourse about automation technology in retail, as is the case of cashier-free supermarket stores, which seriously threatens the success of the implementation of this technology. Consequently, for the purpose of this dissertation, it is crucial to assess if Portuguese consumers are unwilling or uncertain about this concept.

*b. The Model*

With the development of technology and its growing importance in consumers' lives, the understanding of what influences technology acceptance and avoidance has grown more relevant over the years. Although self-service shopping has significantly improved, consumers continue to face relevant pain points that are unaddressed by regular cashier lanes and SCOs. This fact generates opportunities for grocery retailers to move past self-checkout machines. However, understanding consumers' willingness to embrace more autonomous technology is key to its implementation. Therefore, to address consumers' attitudes towards smart technologies in supermarket retail, and their intentions to adopt it, it is crucial to acknowledge the Technology Acceptance Model (TAM) (Thomas-Francois & Somogyi, 2022).

The research community's growing interest in addressing this topic has resulted in the development of several theories and models of technology acceptance and its successful adoption. In 1985, Fred Davis introduced the field's current dominant model, the Technology Acceptance Model (TAM). Davis attempted to create an equation capable of predicting the level of acceptance of technological systems.

The model – Annex 1, Figure 1 - takes into consideration five main dimensions: *"(1) Perceived usefulness; (ii) Perceived ease of use; (iii) Attitude toward using technology; (iv) Behavioral intention to use; (v) Actual technology use"* (Baumassepe, 2021).

The TAM "*presumes a mediating role of two variables called perceived ease of use and perceived usefulness in a complex relationship between system characteristics (external variables) and potential system usage*." (Marangunić & Granić, 2015). Perceived usefulness is the "*subjective judgment of the potential user's utility*" of a new technology, whilst perceived ease of

use is the "*cognitive effort expended by a potential user*" when learning how to use a new technology. (Yand et al., 2021). Both constructs come together to measure the consumer's motivation - attitude toward use. Davis believed that "*the attitude of a user toward the system was a major determinant of whether the user will actually use or reject the system*." (Marangunić & Granić, 2015).

A 2021 study for the Global Business & Finance Review Journal applied the TAM to investigate consumers' intention to use SSTs in China. Results proved that perceived usefulness and perceived ease of use "*had positive effects on customers' attitude and behavioral intention in the context of using SSTs*" (Yand et al., 2021).

Mystery Shopping

Mystery shopping is a "*tool used by companies to measure the quality of service (...) and the overall experience of the everyday customer*" which dates to the 1940s when it was primarily used to assess employee integrity (PamInCa, 2009). Currently, the primary goal of this instrument is to "*monitor the quality of processes and procedures used in the delivery of a service, rather than the outcomes of a service encounter*" (Wilson, 1998). It is a very powerful tool for organizations looking to improve their service quality, as it provides in-depth insights into consumers' experiences and perceptions.

Mystery shoppers are "*common people who visit a variety of business locations and (...) make observations based on the particular requests of each client*" (PamInCa, 2009).

Consumer Psychology

*a. Theory of Consumption Values*

The Theory of Consumption Values (TCV) was introduced by Sheth, Newman and Gross, in 1991. It illustrates the buying behavior of consumers concerning their consumption values. The theory aims to answer the question of why consumers decide for or against the purchase of a certain item, a series of products, or a brand (Tanrikulu, 2021). To address this question, the TVC encompasses the following five consumption values: (i) functional value; (ii) social value; (iii) emotional/hedonic value; (iv) conditional value; (v) and epistemic value - see Appendix 1, Figure 2 (Sheth, et al., 1991).

The degree to which a consumer's need is satisfied is known as consumption value. It is based on the individual's overall evaluation of a product's net utility or level of satisfaction after purchase (Tanrikulu, 2021).

According to the authors, this theory's application studies consumer choice behavior for many types of products, including durable and nondurable goods and services. For the purpose of the present dissertation, this theory will serve as basis for the analysis of Portuguese consumers' perceptions of supermarket brands.

Previous studies on the field indicate that two of the five dimensions of the TCV are relevant in the current research's context – functional value, the "*perceived utility of a product or service to attain utilitarian or physical performances*" (Sheth, et al., 1991); and hedonic value, the "*perceived utility acquired from an alternative's capacity to arouse feelings or affective states*" (Sheth, et al., 1991). Whilst the relative importance of each value will be assessed to understand the relationship between Portuguese consumers and supermarket brands, the latter were used for perceptual mapping, in the context of the brand personality construct.

*b. Brand Personality Construct*

Personality is a concept attributable to humans. It can, however, be used to illustrate the characteristics of non-human beings, such as brands. The "*transmission of human characteristics to non-human things and events*" (Guthrie, 1997) is referred to as anthropomorphism. Through this process, consumers tend to attribute positive characteristics to products and brands to maximize feelings of comfort and familiarity when using them (Haigood, 1999), whilst allowing for self-expression, facilitating relationships, and simplifying the process of brand choice (Freling & Forbes., 2005). Consequently, different brands may hold very recognizable personality traits (Plummer, 2003).

The brand personality concept is especially relevant in the domain of retail outlets because of the existence of multi-level relationships between customers and stores (Lockshin, 1997). Consumers can develop strong personal relationships with store brands and names, with store employees, and with the stores themselves.

Jennifer Aaker (1997) defines a brand's personality as "*the set of human characteristics associated with a brand*". To understand how the relationship between brand and human personality may drive preference, the author developed a five-dimension brand personality scale (Aaker, 1997). Through Aaker's model, the following five personality dimensions associated with brands were identified: Sincerity, Excitement, Competence, Sophistication, and Ruggedness.

However, the replication of the framework in multiple geographies has proven that the scale is not stable in different cultural contexts (Ferrandi, 2000) and that some dimensions have no real equivalents in terms of human personality. As the viability of brand personality scales is often questioned by critics, "*consumer behavior researchers must develop their*

*definitions and design their own instruments to measure the personality variables that go into the purchase decision"* (Kassarjian, 1971). Consequently, this paper will follow an ad-hoc approach to the brand personality scale. In other words, an adapted brand personality scale was developed, considering the specific service category being studied: supermarkets using advanced SSTs.

*c. Brand Personality Scale: Ad Hoc Approach*

A company's success is dependent on how consumers recognize innovativeness at the brand level, rather than the actual product or service attributes of the innovation (Einhorn & Arndt, 2010). In other words, it is likely that consumers equate brand names with perceived innovativeness, rather than actual product innovations. Furthermore, previous studies aiming to examine brand innovativeness have found that "*innovative brands are related with several interesting core and secondary associations that have not been adequately addressed in previous research*" (Shams et al., 2015). Innovativeness has been described by consumers across two dimensions: novelty – understood as the relative difference between current and past offerings (Garcia & Calantone, 2002); and meaningfulness – understood as the degree to which a brand's offerings are perceived as valuable and useful (Rubera et al., 2011).

Therefore, for the specific purposes of this research, the following three dimensions were added to Aaker's original framework: Innovation, Novelty, and Meaningfulness. The adapted brand personality scale includes eight brand personality dimensions, described in Appendix 1, Table 1, and will serve as grounds for the construction of this dissertation's perceptual map.

Marketing Frameworks

*a. Positioning, Branding, and Perception in Marketing*

Perception is "*the process by which an individual selects, organizes, and interprets information inputs to create a meaningful picture of the world*" (Kotler & Keller, 2015). This process is dictated by the individual's values, beliefs, needs, experiences, and environment (Chadha & Kapoor, 2008). In any market, consumers´ perceptions are crucial to the success of companies, because consumers will associate a brand's name with specific attributes, particular benefits, features, and characteristics. These associations will result in the unique placement of brands in the mind of target customers – positioning. Building a strong brand is crucial in any competitive business, therefore, positioning is a key managerial activity responsible for shifting consumers' perceptions and guaranteeing a sustainable position in the market (Gigauri, 2019).

Perceptions strongly influence buying behavior, which explains how positioning leads to competitive advantage. Positioning service brands is more difficult than positioning a product, because of the need to communicate vague and intangible benefits (Assael, 1985). In the study of service marketing, retailers such as supermarkets are classified as service providers. In general, supermarkets provide the following services: presentation of products to allow for easy and convenient purchases; additional services such as parking and delivery; enjoyable shopping experiences through the design of the stores; and SSTs - the focus of this dissertation. Consequently, these grocery retailers depend on shoppers' usage of a service, increasing the necessity of understanding customers' perceptions (Gigauri, 2019). Brands must put effort into finding a place in individual consumers' perceptual space. Consequently, battles of perception are currently witnessed over battles of products.

*b. Perceptual Mapping*

The visual representation of consumer perceptions through perceptual maps allows for successful positioning strategies and confident decision-making regarding marketing efforts to exert influence on customers' minds. Perceptual mapping has been historically considered as one of the most valuable analytical tools in marketing (Green & Srinivasan, 1990), and can be defined as the graphical technique for visually representing potential customers' perceptions (Gigauri, 2019). The technique is used to portray a brand's image, by describing the consumer's perceptions of brands on one or a series of spatial maps, allowing for the visual study of relationships between the brands (Chadha & Kapoor, 2008). The distances between the brands will demonstrate their differences or similarities and are quantified by the variables (Gigauri, 2019).

The variables can be a "*set of attributes or rank-orderings, evaluated by the consumers based on their perceptions of the brands*" (Dallakyan, 2014). Acknowledging consumers' perceptions and associations is the first step to collecting insights regarding brand preferences. By illustrating how the target consumers view competitive alternatives in the market space, "*perceptual mapping offers a unique ability to understand market structure, analyzing the complex relationships among marketplace competitors and the criteria used by buyers in making purchase decisions and recommendations*" (Nigam & Kaushik, 2011). It facilitates a clear definition of the target segment and the development of a unique positioning strategy, as well as reviewing the performance of previous positioning strategies.

For the purpose of this dissertation's perceptual mapping efforts, data collected about consumers' perceptions using the eight dimensions mentioned above (see Brand Personality Construct) will be studied through a common factor analysis (CoFA) in SPSS.

Factor Analysis is "*an interdependence statistical technique that seeks to determine the number and nature of latent variables or factors that explain the variation and covariation in a set of observed measures*" (Brown, 2015). Some expectations exist regarding the structure of relationships between the dimensions being studied, mainly the prediction of a group of high correlations between sophistication, innovation, and novelty. Nonetheless, an explanatory factor analysis (EFA) will be computed, assuming that there will not be any specifications regarding the number of factors to be extracted. (Rogers, 2022)

SPSS uses the PCA as a tool for the extraction of underlying common factors due to its lower need for computation power. Whilst both PCA and EFA will seek to reduce the set of dimensions into fewer variables (or factors), these statistical techniques are not the same: "*EFA can be used for data reduction and for other purposes, but PCA can only be used for that purpose*" (Rogers, 2022). In sum, the application of the CoFA is expected to summarize the relationships between the dimensions in a limited number of factors. If two factors are extracted, for example, a two-dimensional perceptual map can be used to plot both the dimensions and brands of the study. In turn, this will allow for the extraction of valuable conclusions regarding RQ1.

Conjoint Analysis

*a. The Method*

Conjoint Analysis is a methodological approach to the study of consumer preferences, developed by Luce and Tukey in 1964. The methodology allows for the understanding of how "*the various characteristics of a product contribute to its overall attractiveness, or better yet to its overall profitability*", and was popularized as a research tool after its introduction in marketing by Green and Rao, in 1971 (Vriens, 1994).

The analysis can be defined as a "*major set of techniques for measuring buyers' tradeoffs among multiattributed products and services*" (Green & Srinivasan, 1990). By breaking up overall utility into preference parameters, such as partworths, the method is decompositional in its approach (Aggarwal & Vaidyanathan, 2003).

In order to gain insights into consumer preferences, the technique can be summarized and organized in the following steps (Vriens, 1994). Firstly, the definition of the product or service through a confined amount of key characteristics, commonly known as attributes. These descriptive features can be objective or subjective, and influence customer preference. Then, these attributes must be defined on a number of levels. Translating these concepts to the space of supermarket retail, if the attribute being studied is, for example, "*supermarket size*", potential levels are: "*large supermarket – 2500 sq. meters*", "*medium supermarket – 1440 sq. meters*", and *small supermarket – 790 sq. meters*" (Saridakis, 2009). The combination of attributes and their corresponding varying levels results in a set of full profiles, which must be evaluated by an appropriate sample of respondents. Through that, study participants are providing numbers linked to each level, which allows for the measurement and extraction of buyer's tradeoffs. "*The numbers attached to these levels are called partworth utilities. Summing the partworth utilities, which belong to a certain profile, yields the overall utility if the additive model is used. It should be noted that the levels of the different attributes are quantified on one common scale: the utility-scale*" (Vriens, 1994). Once partworth utilities have been estimated, an in-depth analysis of the results through a multitude of statistical tests can help solve the specific marketing problems at hand.

Regarding limitations, the method becomes increasingly difficult to execute as the number of attributes and levels rises (Green & Srinivasan, 1990). Therefore, it can be challenging for low-

resourced researchers. Furthermore, Witdnk and Cattin (1989) estimated that the large majority of conjoint analyses (77%) were applied to consumer and industrial goods. Most product-related studies concerned decisions of "*product modifications, optimal product design, the redesigning of product lines, and the development and evaluation of new product concepts*" (Vriens, 1994). Thus, the lack of application in the service sector is a relevant obstacle to this dissertation.

*b. Prior research*

In the past 15 years, a few research studies have focused on the application of conjoint analysis in supermarket retailing. Nonetheless, for the aim of this dissertation, the focus is on checkout methods in supermarket retail, mainly checkout-free technology. A 2013 study by Dwane H. Dean attempted to anticipate consumer reaction to RFID-enabled grocery checkout. Radio Frequency Identification (RFID) tags are an example of a technological innovation used in checkout-free technology. (AI Multiple, 2022). Through this study, Dwane emphasized that their research was exploratory, and should be developed in the future through the construction of a conjoint analysis. However, no relevant literature was found on the topic.

Still, a 2009 study for The International Review of Retail, Distribution and Consumer Research, by Charalabos Saridakis, focused on the application of a conjoint model for the identification of the UK supermarket choice determinants. The study is "*amongst the largest conjoint applications in the literature of retailing*" (Saridakis, 2009), and aimed to identify which attributes drive supermarket choice, and their relative importance. Regarding the first step of the conjoint methodology – definition of attributes -, the paper analyzed four attribute groups: (i) merchandise – including "*quality of fresh foods and vegetables*", "*presentation of products on the shelves*", "*variety of product categories*", "*level of prices*", "*store brands*", and "*assortment*";

(ii) layout – including "*supermarket size*"; (iii) clientele – including "*number of customers*", and "*location*"; (iv) convenience – including "*distance*", "*opening hours*", and "*parking facilities*". It was found that merchandise-related attributes are the most relevant facet, whilst "*distance*" is the most important attribute: "*it is obvious that UK consumers are not willing to travel*" (Saridakis, 2009).

Later, in 2011, the Journal of Promotion Marketing conducted "*a full profile approach of conjoint analysis (...) to assess the impact of attributes on grocery shopping preference*". The study was conducted in a mid-western college town in the United States and used the following eight attributes: *"(i) customer service from the grocery store staff, (ii) shopping time efficiency, (iii) price or monetary efficiency, (iv) store layout, (v) store accessibility, (vi) affiliated services, (vii) variety of goods carried, and (viii) quality of goods carried*" (Agrawal, D. et al., 2011). Results found that product quality, store accessibility, and product variety were, on average, the attributes of highest relevance for respondents. Therefore, the conclusions are on par with the previous paper.

Supermarket Checkout Methods

Grocery shopping has undergone revolutionary changes over the recent years. Technological innovations have substantially influenced how supermarket players deliver their services and stay competitive in the context of globalization. The growing popularity of Self-Service Technologies (SSTs) leads to constant innovation in this sector. Nowadays, advanced technologies offer consumers digitized operations and frictionless checkout experiences. The tendency to adopt SSTs requires consumers to have an active participation in the production process of the services enabling them to "*co-produce the service with a minimal or no involvement of service*

*provider's employees*" (Meuter et al., 2000). Cashier lane's popularity is now decreasing, opening a path of growth for SSTs, as both consumers and retailers can benefit from this change.

First and foremost, customers' in-store retail processes are enhanced, as overall convenience is increased through higher autonomy and by avoiding long queues or even entire the checkout process (Qikserve, 2018). Also, an interesting advantage is the fact that consumers are provided with consistent services, as this method does not depend on employees' personalities and moods (Elliott, Meng, & Hall 2008; Weijters et al. 2012).

As for the retailers, there is a possibility to cut costs by reducing the in-store staff (PwC, 2017), increasing service availability, achieving consistent and standardized service atmospheres, and optimizing floor space (Agnihothri et al. 2002; Collier & Kimes 2013; Weijters et al. 2007). Store operators are freed of the repetitive chore of cashing out, and instead, can focus on activities that have a bigger impact (Fernandes & Pedroso, 2016).

Even though SSTs are becoming progressively popular, there are still relevant inconveniences that must be addressed. The potential benefits of SSTs are attractive; however, customers need to be able to embrace and use these new technologies (Lin & Chang, 2011). The responses towards participating in this process are not always as positive as expected (Dong et al. 2015). Hostility to SSTs can bring supermarkets financial losses, compromising their return on investments (Walker et al. 2002). Unpleasant experiences when using these new service options can compromise general customer satisfaction, and intention to reuse and recommend, therefore affecting retailer´s profits (Falk et al. 2007).

Supermarket brands face the new challenge of understanding how consumers will behave when facing these technologies, especially in the Portuguese market, as there are still few studies on

the topic. Adding to that, retailers need to support an expensive manufacturing cost, and the security system of SSTs is unperfect, which raises questions of theft.

In the following section, the three supermarket checkout methods explored throughout this dissertation will be explained, in order to better understand their respective components and processes, as well as relevant differences between them.

*a. Cashier Lane*

Supermarket cashier lanes are the most frequent checkout method found in Portuguese retailers. In this method, the checkout process - scanning, payment, and placing the purchased items into shopping bags - is conducted with the total assistance of a cashier operator.

*b. Self- Checkout*

Self-Checkouts (SCOs) are one of the forms of SSTs (Rinta-Kahila et al., 2021). The first retail self-checkout system was developed in the 1990s by Dr. Howard Schneider. By 2003, self-checkouts were already widely used in retail establishments across the world. Nowadays, supermarket brands have been leveraging technological advancements to increase their productivity through the implementation of self-service technologies, especially in the form of self-checkout counters.

In this checkout method, the customer is responsible for checking out their purchases without direct assistance from in-store assistants, through a sequence of directions displayed in the self-checkout machine. Consumers must scan and bag their items and pay for them autonomously. Thus, shoppers' participation, knowledge, and skills to complete the transactions will influence the success of the service provided. Nevertheless, self-checkout areas are supervised by service employees to control and assist customers (Leng & Wee, 2017).

These employees ensure that the process runs smoothly, by assisting customers struggling with the technology, or in cases of technology failure (Demirci & Kara, 2014).

*c. Self-Checkout Process*

Once consumers have selected the products that they want to purchase, the checkout process is guided via the touchscreen of the checkout machine. Customers must scan the barcode of each item themselves. The software identifies each item and adds it to the bill, displaying it on the terminal. For products such as fruits or vegetables that need to be weighed, the machines are equipped with scales. The customer must identify the product being weighed in the system, which in turn will indicate the weight and the corresponding price. Although this is the most common process, some stores offer a more innovative method where "*RFID tags (...) replace the original barcodes on products*" (Jie & Kamsin, 2021): shoppers can directly place their shopping bag/basket on the counter and all products are scanned simultaneously by the machine (Demirci & Kara, 2014). Depending on the retailer, the customer can be offered several payment methods, such as card or cash, and, in some cases, a supermarket specific app.

*d. Checkout-free Technology*

The idea of rethinking the physical shopping experience by eliminating the cashier lane and SCO queues was originally conceptualized by three men working for Amazon, in 2012. In the following year, the retailer patented it's Just Walk Out technology, characterized as a system that combines several technologies able to track consumer movement and activity in-store, and automatically sync information to their mobile devices. The combination of technologies includes high-resolution cameras and a variety of sensors, as well as deep learning and artificial intelligence. For example, through radio-frequency identification (RFID), the technology is

able to identify when customers remove an item from the shelves. RFID can improve business operations by increasing the accuracy of product tracking and lead time via electromagnetic coupling in the radio-frequency portion (Rungruengkultorn & Boonsiri, 2022). In December 2016, Amazon announced the opening of the first Amazon Go store using the Just Walk Out system, in Seattle. Due to issues with the technology, the grand opening was often postponed, but finally took place on January 22nd, 2018 (Kastrenakes, 2017).

*e. Checkout-free Technology Process*

The shopping process using the checkout-free technology can be described in six steps (Purwantono et al., 2021). First, the customer must download a mobile phone application in order to enter the store. The process of setting up the app will usually require payment information for a more seamless experience when exiting the store. At the store's entrance, the customer must scan their in-app profile (by using QR or barcodes). As the customer collects products from the shelves, the system can either automatically add the items to the in-app shopping cart, or consumers may need to scan the item with their phone camera in the app. Similarly, in order to remove an item from the in-app shopping cart, the customer may have to simply place the item back on the shelf or remove it from the in-app shopping cart manually. These slight differences in the checkout-free shopping experience are determined by the technological level of the store's service. Once the customer exits the store, the total price of the added items will be automatically withdrawn from the application's added payment method (Purwantono et al., 2021).

*f. Checkout Free Technology in Portugal*

Currently, only two supermarket stores in Portugal offer the checkout-free technology service. The first one opened in 2019, when the Portuguese retail group Jerónimo Martins launched the

Pingo Doce & Go Lab Store, located at the Nova SBE campus, in Carcavelos. The group stated that their goal was to "*offer a convenient shopping experience in less than a minute*" (Pingo Doce & Go Lab Store, 2019). Later, in 2021, Portuguese retailer Sonae launched Continente Labs, located in Saldanha, Lisbon, stating that "*shopping can now be faster and more convenient than ever*" (Continente Labs, 2021).

Although both stores offer a similar shopping experience, by targeting the same consumer pain-points, relevant differences in their technology result in slightly distinct processes. These differences – summarized in Table 1 - will be further analyzed in this dissertation's methodology and analyses sections.

Table 1 – Pingo Doce & Go Nova vs. Continente Labs Checkout-free process

| | **Pingo Doce & Go Lab Store** | **Continente Labs** |
|---|---|---|
| **Entering the store** | • Mobile app is required (installed and with profile created).<br>• A QR code is generated to enter the store. | • Mobile app is required (installed and with profile created).<br>• Approaching the barriers that open automatically. |
| **Selecting the products** | • Scanning the barcode of the product through your phone. | • Grabbing the desired item (no need to scan). |
| **Removing the products** | • Manually — by pressing the "minus" symbol on the quantity of the product — or by touching the mobile phone to the barcode again. | • Putting the item back on the shelf. |
| **Payment** | • Payment through the app (credit card associated). No receipt, the purchase is registered in the app. | • Payment through the app (credit card associated). No receipt, the purchase is registered in the app. |
| **Leaving the Store** | • The app automatically generates a QR code to present on departure. | • If the payment was done through the app, a QR code is automatically generated to present on departure. |

After the visit, the mystery shoppers were asked to answer the following questions using a 5-point Likert scale (1 – "Extremely unlikely"; 2 – "Quite unlikely"; 3 – "Neither"; 4 – "Quite likely"; 5 – "Extremely likely"):

1. *Using checkout free technology would make my grocery shopping quicker.*
2. *Using checkout free technology would make my grocery shopping easier.*
3. *I would find this technology useful in my daily life.*
4. *I would prefer a checkout free store over a regular store.*
5. *I would visit more checkout free stores in the future.*
6. *Learning to operate checkout free technology would be easy for me.*
7. *I would find it easy to install and use the app needed for these services.*
8. *My interaction with this technology would be easy and understandable.*
9. *I would find it easy to add and remove items from my cart.*
10. *I would find it easy to pay for my groceries with checkout free technology.*

These questions were adapted from a 2019 study from, where the Technology Acceptance Model (Davis, 1989) was manipulated into multiple TAM questionnaires. Furthermore, "*formulas were used to put PU and PEU on a 0–100-point scale, averaging PU and PEU to get the overall TAM*" (Lewis, 2019). Accordingly, questions 1-5 concern the participants' Perceived Usefulness (PU), whilst questions 6-10 concern the participants' Perceived Ease-of-Use (PEU).

Furthermore, besides some additional Yes/No questions, a short follow-up interview took place with the shoppers to better understand certain moments of their experience.

*i. Results and Discussion*

In total, four mystery visits were completed. Because of the very small sample size, this analysis is purely exploratory. Nonetheless, it was valuable for our analysis. The incentives and disincentives that the participants encountered were of special relevance to the Conjoint Analysis conducted later. Appendix 4 summarizes each mystery visit.

In Continente Labs, both shoppers encountered challenges related to payment methods, but also highlighted helpful and positive interactions with the staff. App-related problems, namely with the virtual shopping cart, were also emphasized by one of the Pingo Doce & Go shoppers. Lastly, all shoppers stated that using checkout free technology would make their grocery shopping quicker. These findings are especially relevant to the Conjoint Analysis conducted later in the dissertation, as they highlight key attributes that play a big role in the consumers' interactions with checkout free technology. These attributes were payment method, level of employee interaction, and time for checkout.

In general, perceived usefulness is greater than perceived ease of use, with score averages of 72% and 62%, respectively. These values change to 86% and 70% when looking solely at Continente Labs, and to 64% and 62% for Pingo Doce & Go Nova. This leads to the tentative conclusion that the more modern technology of Continente Labs is generally perceived as more potentially useful to Portuguese consumers, whilst simultaneously representing a smaller obstacle regarding ease of use for consumers. Consequently, the average values for TAM are higher for Continente Labs (78%, versus 63%). This finding may indicate that more advanced technology can be beneficial to brands looking to invest in checkout free technology.

Furthermore, the Mystery Shopping experience resulted in some preliminary insights, mainly valuable to predict the answer to the dissertation's third research question: how does the age

factor impact Portuguese consumers' interest in checkout free technology? Whilst the TAM average for the two younger shoppers was 85%, this number falls to 56% when looking at the older shoppers – aged 52 and 59 years old. This drop of nearly 30 percentage points is an additional finding that supports the existing evidence that interest in checkout free technology is inversely proportional to age.

Quantitative Methods

As previously explained in the methodology diagram, qualitative research methods were used to gather valuable insights, that in turn were crucial to the construction of quantitative research methods: a perceptual mapping survey which will collect data regarding brands perceptions, and a conjoint analysis survey that will focus on supermarket checkout method preference. Both surveys collected the same demographic characteristics about respondents.

*a. Surveys Design - Sample Demographics*

The way consumers act is heavily influenced by a variety of factors such as age, gender, wealth, education, tastes, and other characteristics. In fact, previous studies indicate that demographic factors have a significant influence on consumer behavior (Bindal, 2014). Interestingly, Simon and Usunier (2007) have concluded that age can have a strong influence on the preference for using SSTs.

Therefore, at the end of the perceptual map and conjoint analysis surveys, demographic information was collected with the intention of understanding how different demographic factors could affect consumers' perceptions (addressed in the perceptual map section) and preferences (addressed in the conjoint analysis section). Although both surveys run on different platforms, for comparison purposes, the surveys were developed with the same exact demographic questions.

This research focuses solely on the Portuguese market, as it represents the main potential customers for supermarkets in the country, and to ensure a representative sample, nationality is questioned. For this same reason, the surveys were developed in Portuguese, as language can be a barrier for some of the respondents, especially with an older age. Although there's still a lack of information regarding age on the TAM due to its recency, studies have found that it significantly impacts the future intention of technology adoption and use (Chung et al., 2010). Therefore, survey information is collected per age gaps: 18-24, 25-34. 35-44. 45-64, 65+ (following Computers in Human Behavior, 26(6), 1674-1684). This is due to the fact that perceptions towards the use of self-checkout and checkout-free technologies differ among age groups, whereas expected that the younger generation is more inclined towards the usage of automated technologies in supermarkets (Neate, 2022), in contrary to older generations.

Survey data will be divided by Portuguese living area, gender, level of education and professional status, and annual income, with the main intention to evaluate if these are impacting factors on checkout-free technology adoption.

## 5. Perceptual Mapping

Survey Design

The perceptual mapping survey was assembled in Google Forms after the consumers' and experts' interviews, as well as the mystery shopping experience and the literature review.

Answers were collected from October 26th to November 4th. The survey was promoted on personal social media accounts – LinkedIn, Instagram, and Facebook - and shared in multiple WhatsApp groups. Thematic Facebook groups also played a big role in the survey's promotion,

as there are groups with tens of thousands of Portuguese consumers who use these platforms to share ideas and questions about multiple supermarket brands. Online threads about the topic were also used to share the survey.

The first question of the survey was about the nationality of consumers, working as a filter: only Portuguese respondents were led to the second section of the survey, whilst for the remaining, the survey was automatically submitted. This should guarantee that the results are relevant to the research questions in analysis.

The second section asked about brand preferences and introduced respondents to the five brands being analyzed in this dissertation: Pingo Doce, LIDL, Auchan, Continente, and Minipreço. These brands were chosen based on their most recent turnover values (Appendix 5, Table 1). Although the overall turnover varies greatly from the numbers in Portugal, it made sense to use the latter since we are solely focused on the Portuguese population. The order in which the brands appeared in the survey always represented their rankings in terms of turnover in Portugal. In this section, respondents were asked to rate each brand from least to most favorite.

The third section of the survey intended to assess how Portuguese consumers perceived each supermarket brand according to the adapted brand personality scale developed. Respondents were asked to rate the brands based on all eight dimensions of the construct: Sincerity, Excitement, Competence, Sophistication, Ruggedness (Aaker, 1997); Innovation (Su et al, 2015); Novelty, and Meaningfulness (Shams et al., 2015). For each one, a short description highlighted the main personality traits linked to the dimension (Appendix 5, Table 2).

For this part of the questionnaire, a single-item scale was adopted. Instead of individually rating each personality trait, respondents had to evaluate the dimension as a whole, leaving them with

greater uncertainty to understand their meaning. Although potentially more vulnerable to unknown biases in interpretation, this allowed for a shortened survey length. Consequently, the questionnaire was less monotone and time-consuming, minimizing participant burden. Additionally, single-item measures have been suggested in the literature for measures such as the Big Five construct of personality (Hoeppner et al., 2011).

Furthermore, a forced Likert scale was implemented. The Likert scale is a point scale commonly used in research, as it allows individuals to express their judgments and attitudes toward a subject matter (McLeoad, 2008). In this case, it was used to rank respondents' perceptions of supermarket brands, regarding each dimension, from low to high. Typically, the Likert scale is a five- or seven-point scale. However, for the purpose of the survey, a 4-point Likert scale was used to force the participants to form an opinion due to the lack of a middle option. Although this scale may hurt the number of the total responses, as certain respondents do not feel comfortable not having a neutral, it works best when recording opinions of services that the respondent has experienced. According to the "Polygamous Store Loyalties: An Empirical Investigation" study, 83% of shoppers regularly visited between four and nine grocery stores in the span of one year (Zhang et al., 2017). Thus, it is assumed that households usually split their grocery shopping among many different stores. Translated to this dissertation, most survey respondents are expected to have experienced the services offered by the five supermarket brands being studied. If for some reason respondents were unfamiliar with one of the brands, they were offered the option of "I do not know this brand" option.

Concerning the attributes and levels, all can be found organized in Appendix 5, Table 3.

Finally, in the fourth section of the survey, additional data was asked to characterize and segment the sample. These questions asked about gender, age, region, professional status, annual

income, and qualifications. The following section addresses the sample characteristics, regarding these demographic dimensions.

Sample Characteristics

In total, 101 answers were collected (N=101) (see Appendix 5 – Sample Characteristics), from which 99 (98,02%) refer to Portuguese and 2 (1,98%) refer to non-Portuguese (which will not be considered) (n=99).

A nationality exclusion rule was applied, this is, the survey would automatically reach its end if the nationality answer was "other" besides "Portuguese". Demographic questions only appear at the end of the survey. Next, sample characteristics will be analyzed, to better understand the distribution through demographic characteristics, and how does may affect the results.

*a. Age*

Age distribution was divided into the following age groups: 18-24; 25-34; 35-44; 45-54; 55-64 and 65+. More than half of the sample belongs to the 18-24 age group (61.62%), while the number of answers from the other age groups is lacking and disproportionate. By analyzing the data per age group (see Table 5 and Graphics 2 and 3, Appendix 5), it can be easily stated that age distribution is not equal, since the mean of the age scale does not accurately estimate the mean of the population (Wilcox, Bellenger, & Rigdon (1994)). Accordingly, the sample gathered is not representative of potential Portuguese consumers. This can be explained by the fact that the present study is being conducted by students and, consequently, their personal network is mostly made up of people in the first age group.

*b. Gender*

By analyzing the gender of Portuguese respondents (Appendix 5, Table 6), it can be observed that 58 are female (58.6%), 39 are male (39.4%), and 2 (2%) identified as "other". Although there's a lower difference between the more significant genders (male and female), around 20, there's still an overload of female answers versus male. This difference can be explained due to the fact that in Portugal "*the number of women has always outnumbered men since 1864*" (Statista 2022).

*c. Location*

In order to advise for future strategic decisions regarding the expansion of this new automated technology in new locations, the survey's answers were also divided by the following living areas of Portugal: North Region, Lisbon Region, Center Region, Alentejo Region, Algarve Region, Autonomous Region of Madeira and lastly Autonomous Region of Azores. As it can be observed in Table 7 (Appendix 5), Porto (58.6%) and Lisbon (29.3%) regions are dominant, followed by Centro (8.1%), Algarve (3%), and Azores (1%), and no responses were collected from Alentejo and Madeira. The difference in the number of responses by living area can be justified by the fact that the Portuguese population is not equally distributed through the regions of the country. In fact, the north has a higher population of 3.590.846, followed by Lisbon with 2.873.618, and the Center with 2.235.767, and Madeira and Azores are the regions with the lower population, around 240.000 (INE 2021).

*d. Professional Status*

When it comes to professional status, more than half of all respondents (52.5%) reported currently being employed ("Empregado"), followed by 37.4% being students ("Estudante"). The remaining 10.1% were retired (6.1%) or unemployed (4%) people.

As of November 2022, the unemployment rate in Portugal reached 5.8%, slightly above the sample's results (INE, 2022). However, as of March 2022, the number of old-age pensions in Portugal represented nearly 20% of the country's population, whilst the total pensions represented nearly 35% (PORDATA, 2022). The difference between these numbers and the 6.1% of retired respondents in the sample can be explained by the fact that the sample is extremely skewed toward younger people. Whilst Portugal is a country with a prominent elderly population – 23.2% of the population was aged 65 and above in 2021 (World Bank, 2021) -, the study's sample only registered 7.1% of respondents above 65.

*e. Annual Income*

As far as annual earnings go, one-third of the sample (33.3%) did not report having an income source. Whilst 11.1% of the respondents wished to not state their income status, the remaining respondents were almost evenly split amongst the different income ranges. According to PORDATA's 2020 statistics on the distribution of households by income bracket (IRS), it is possible to understand that, from the people who reported having an annual income (83.8% of the sample), the results match the overall scenario of Portugal's general population, apart from the top brackets (Appendix 5, Table 8).

*f. Qualifications*

Respondent's qualifications were the final descriptive variable measured. Of all 99 respondents, 95.9% have studied for at least 12 years: 54.5% have a bachelor's degree ("Licenciatura"); 21.2% have a master's degree or higher qualification ("Mestrado ou superior"); 13.1% have an high school diploma ("Ensino Secundário – 12º ano"); 3% have a CET course ("Curso de Especialização Técnica"); 3% have a post-graduation degree ("Pós-graduação"); and 1% have a professional school diploma ("Ensino Profissional – 12º ano"). The remaining 4% has a basic

school diploma or lower qualification ("3º Ciclo – 9º ano, ou inferior"). The study's sample is clearly skewed toward highly educated people. According to PORDATA, as of 2021, 49.5% of Portugal's population had studied for at least 12 years (PORDATA, 2021). In comparison, the sample's results represent approximately a 193.8% increase in this segment. This is mainly a consequence of the over-sampling of university students.

Results and Discussion

*a. Factor Analysis – Entire Sample*

Data from the perceptual map survey was extracted and cleaned before being imported into SPSS - a powerful statistical software platform allowing for data preparation and management for analysis and reporting (IBM 2022). The SPSS input was the average score of each dimension of the project's ad-hoc approach to the brand personality scale per supermarket brand, as seen in Table 9 (Appendix 5).

The interpretation of the data began with a Factor Analysis, with the goal of understanding which potential underlying factors were being measured by the total eight observed variables. In other words, SPSS tries to find patterns of correlation through groups of variables that are highly correlated. Each group would represent an underlying common factor. If measures are highly correlated (positively or negatively) then they are probably determined by the same factors, while those that are uncorrelated are likely influenced by distinct factors.In Table 10 (Appendix 5) it is possible to observe one of SPSS' outputs – the correlation matrix. All values of correlation registered are positive and very high, with a minimum correlation of 0.872. In other words, the entire set of questions forms one group that represents an underlying common facr

Most especially, age drastically impacts the observed utility values. The average partworth utility for checkout-free technology of 42.01% drops sharply to -42.66%. To balance this, the average for the cashier lane of -43.14% jumps to 57.34%. For self-checkout, the average of 1.12% falls to -14.68%. As expected, technology avoidance is a pertinent concept that heavily impacts the preferences of consumers in the older age segments of the sample (above 45). These findings are on par with the expected results. As previously mentioned in the Expert Interviews segment, the target group for these technologies in Portugal is currently "*young college graduates*". Conclusions from the Customer Interview segment are also aligned with these values: the oldest interviewee emphasized technology illiteracy and fear of embarrassment from struggling to use these technologies as crucial factors that stop them from being willing to try SSTs. In order to address this finding in more detail and find an answer to this dissertation's fourth research question (RQ4: How does the age factor impact Portuguese consumers' interest in checkout-free technology?), the following section of the analysis will focus solely on checkout-free technology.

*a. Checkout Free Technology – Entire Sample*

Checkout-free technology is catching the attention of most consumers, as seen by the previous results. In addition, the lack of studies of intelligent automation applied to the check-out process in the supermarket retail industry magnifies the relevance of this section of the Work Project.

First, in order to understand what pair of attributes represents the largest trade-off in the mind of Portuguese consumers, all attributes were the object of a Pearson correlation test (pairwise). Appendix 7, Table 12 highlights the significant pairings, considering a 95% confidence interval. The most relevant correlation of statistical significance identified is a negative correlation between the cost of service and time for checkout (-0.557). This means that when the importance of the cost of the service decreases, the importance of time for checkout increases, and vice versa. In other words, most of the price value of this technology is correlated to its benefit of timesaving over other methods of checkout. This should also mean that a consumer's willingness to pay is mostly affected by the time saved by using the checkout-free technology – this hypothesis will be tested further ahead in the Willingness to Pay section of the dissertation. Nonetheless, given the fact that the cost of service (68.27%) is approximately 6 times more important to Portuguese consumers than the time for checkout (11.17%), this indicates that consumers are willing to tolerate longer queuing and checkout times for lower prices. "*With inflation at all-time highs, customers are prioritizing saving money. Even the most advanced self-checkout technology won't revert this trend in the short term*." (Heubel, 2022). Therefore, the implementation of a membership program or any additional fees that would put a price tag on checkout-free stores would ultimately hinder their success.

Although relevant, the current analysis of the complete sample fails to provide imperative conclusions regarding the target consumers of this technology. Therefore, the following section of the dissertation will look at individual segments in the sample, in order to understand which geographic, demographic, and behavioral dimensions most influence the interest in checkout-free supermarkets, and why.

*b. Checkout Free Technology – Segmented Sample*

Partworth utilities were, once again, computed a total of 21 times (Appendix 7, Table 13), representing all possible segments of the sample, but this time solely focusing on checkout-free technology. A Descriptive Statistics analysis in SPSS, with a confidence interval for mean of 95%, led to the identification of 2 outlier values – highlighted in Table 7. Both outliers are present in the segment of consumers above the age of 45. As expected, age stands out as a variable of added importance.

Table 7 - *Partworth* Utilities - Sample Segmentation. Checkout-free Technology. SPSS Input.

| | | | RELATIVE IMPORTANCE | | | | |
|---|---|---|---|---|---|---|---|
| | | n | PAYMENT METHOD | SCAN-NING | EMPLOYEE INTERAC-TION | COST OF SERVICE | TIME FOR CHECK OUT |
| SEGMENT | **Gender: F** | 55 | 9.40% | 3.60% | 7.50% | 68.40% | 11% |
| | **Gender: M** | 47 | 9% | 3.90% | 7.30% | 68.40% | 11.40% |
| | **Item per trip (<=10)** | 45 | 8.30% | 3.40% | 7.90% | 70.20% | 10.10% |
| | **Item per trip (>10)** | 58 | 10% | 3.90% | 7.30% | 66.70% | 12% |
| | **Age (<=44)** | 73 | 7.30% | 3.40% | 7.80% | 69.40% | 12% |
| | **Age (>44)** | 30 | 14.40% | 4.40% | 6.90% | 65.30% | 8.90% |
| | **Income (until 19.999€)** | 65 | 8.90% | 3.50% | 7.10% | 69.50% | 11% |
| | **Income (above 20.000€)** | 33 | 10.30% | 4% | 8.30% | 66% | 11.40% |
| | **Supermarket trips per month (<5)** | 40 | 9.50% | 4.10% | 7.50% | 68.50% | 10.40% |
| | **Supermarket trips per month (>=5)** | 63 | 9.10% | 3.50% | 7.60% | 68.10% | 11.60% |
| | **Professional status: student** | 36 | 6.10% | 3.20% | 7.50% | 70.50% | 12.60% |
| | **Professional status: employed** | 58 | 10% | 3.90% | 8% | 67.40% | 10.70% |
| | **Qualifications: BSc and above** | 89 | 8.30% | 3.60% | 7.60% | 69% | 11.50% |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Region: Lisbon and Center** | 76 | 8.80% | 3.70% | 7.80% | 68.80% | 10.80% |

In order to further understand the impact of age on consumers' preferences, it is necessary to test if the importance of the attributes of checkout-free technology is, or is not, independent of age. Thus, multiple Analyses of Variance (ANOVA) were run – one for each attribute. The null hypothesis being tested states that there is no difference between the group's means, where younger represents ages below 44 (n=73), and older represents ages above 45 (n=30).

$$H0: \bar{x}\text{Younger} = \bar{x}\text{Older}$$

$$H1: \bar{x}\text{Younger} \neq \bar{x}\text{Older}$$

The results (Appendix 7, Table 15) show that, when considering a confidence interval of 95%, the differences in the means are significant for three attributes: payment method; cost of service; and time for check-out. For these, the p-value is always below the significance level of 0.05, meaning that there is enough statistical evidence to reject H0. On the other hand, the importance of employee interaction and scanning method seems to be independent of the age variable.

Stronger conclusions can be extracted from these results when looking at the individual level partworths for the segment of age above 45 – Appendix 7, Table 16. Payment method emerges as the second most important attribute for these consumers, replacing time for checkout. This explains both outlier values mentioned above. In fact, this group registers a strong preference for not having to use a supermarket phone app (-7.15%). This finding does not come as a surprise. In the Mystery Shopping experiment conducted, the older participant (59 years) claimed to struggle with the installation of the app and had to enter the store without it, by asking for the help of a staff member. This is an important conclusion, especially because the current automated stores operating in Portugal (PD&GO Nova and Continente Labs) require consumers to use an

app. When looking at Cost of Service, the older segment seems to be slightly more willing to pay (with a level partworth of 1.15% for the 2.29€ option, against an average of -0.96%). This finding is sensible, given that most people earn more money at older than at younger ages. Regarding Time for Checkout, the older segment seems to be more willing to wait longer times (with a level partworth of -0.18% for 4-7 minutes option, against an average of -4.42%).

Based on these findings, it becomes possible to answer this dissertation's fourth and final research question (How does the age factor impact Portuguese consumers' interest in checkout-free technology?). In essence, consumers above the age of 45 are not interested in the concept of checkout-free supermarket stores. This segment is specially not keen on installing a phone app to take advantage of this technology. However, the app is what currently offers retailers the ability to track shoppers at an individual level. Furthermore, based on their in-store behavior, the app can deliver personalized messaging to shoppers, influencing consumer behavior throughout their entire visit, and boosting sales. Thus, it would not be in the interests of retailers to remove the app as a necessary requirement to visit their checkout-free stores. Moreover, the group of consumers above the age of 45 seems to place less value on this technology's inherent and central benefit of timesaving.

The fact that Pingo Doce & Go Nova is located at the Nova SBE Campus and that Continente Labs is near Lisbon's university city is no coincidence. Current market players are actively targeting younger consumer groups. At this point in time, widespread adoption of checkout-free technology in Portugal is unrealistic, given that, in 2021, the elderly population (65 and older) represented 23,4% of the total population in Portugal (INE, 2021). In fact, one of the industry specialists - Expert Interviews section - stated that seniors will not accept this store concept and that the digital divide will be stronger in the era of AI, because of automation illiteracy.

Despite the fact that it has been roughly established that, given the current economic climate, the introduction of a membership program or any additional fees will inhibit the success of check-out-free stores, the following section of the Work Project should confirm this finding through an analysis of Portuguese consumers' Willingness to Pay.

*c. Willingness to Pay*

When looking at the percentage of times that a price option was chosen, per check-out method (Figure 16), it is possible to understand that Portuguese consumers are more willing to pay for the most technological method.

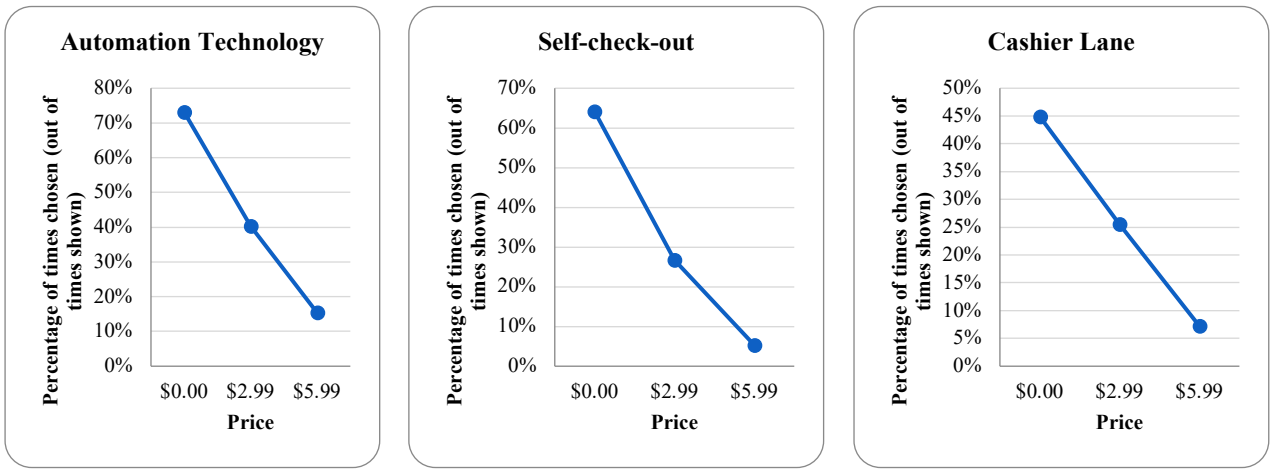


*Figure 16: WTP Preliminary Analysis*

The percentage of times chosen increases, for both price levels, as technology increases. For cashier lanes and self-checkout, the percentages were very similar, averaging 26.1% and 6.25%, for the price of 2.99€ and 5.99€, respectively. For checkout-free technology, these numbers increase to 40.3% and 15.4%, respectively.

In order to compute WTP, it is necessary to look at the level partworths for the cost of service amongst the check-out methods – Appendix 7, Table 17. By looking at the average utility scores,

it is possible to understand that when the price falls from 5.99€ to 0.00€, consumers are registering a utility gain of 12.69. Therefore, 1 utile is worth approximately 0.47€ (the result of 5.99€/12.69).

Looking back at the Partworth Utilities for the Brand Attribute, for the entire sample – Appendix 7, Table 18 - it is possible to estimate the WTP for each check-out method. Hence, it is estimated that Portuguese consumers are willing to pay 60 cents to use checkout-free technology, in a scenario where the other option is only cashier lanes. If the scenario changes and self-checkout machines are available, consumers are only willing to pay 30 cents to use checkout-free technology.

*a. Checkout Free Technology WTP*

Going back to checkout-free technology, and following the same rationale as prior, it is possible to estimate WTP for the different attribute levels. Since a price fall from 5.99€ to 0.00€ corresponds to an average utility gain of 12.60, 1 utile is worth approximately 0.48€.

Appendix 7, Table 19 summarizes how much Portuguese consumers are willing to pay for their preferred attribute levels. In sum, Portuguese consumers are willing to pay 0.48€ to not use a supermarket app; 0.11€ to scan their own items; 0.17€ for employee interaction; and 0.65€ for the fastest check-out times.

It becomes evident that the maximum prices that Portuguese consumers are willing to pay for modern check-out technologies is quite low. As expected, timesaving is the factor with the highest WTP (0.65€). This finding is in accordance with the Perason Correlation developed previously, where the tradeoff between time and cost of service was discussed in detail.

Finally, in order to complement the analysis developed thus far, the following section of the Work Project – Simulations - will allow for a comparison between Pingo Doce & Go Nova and

Continente Labs based on their current models (combination of attributes). Furthermore, some scenarios presupposing model adaptations and the entrance of new players will be analyzed.

*d. Simulations*

The Conjointly platform enables the creation of preference share simulations. For the purpose of this dissertation, multiple simulations were run in order to answer relevant questions related to concept testing, new market player entries, and pricing research.

*i. The current market: Pingo Doce & Go Nova versus Continente Labs*

In order to compute preference shares for the current national market players employing check-out-free technology – Pingo Doce & Go Nova and Continente Labs -, their respective service offerings were described in the language of the attributes and levels included in the study – Table 8. These descriptions were mostly based on the results of the mystery shopping experience.

Table 8 - Attribute levels of Pingo Doce & Go Nova and Continente Labs

| | **Payment Method** | **Scanning Method** | **Employee Interaction** | **Cost of Service** | **Time for Check-out** |
|---|---|---|---|---|---|
| **Pingo Doce & Go Nova** | Supermarket App | Scan your own products | Low to none | Free | Less than 3 minutes |
| **Continente Labs** | Supermarket App | No scanning necessary | Medium | Free | Less than 3 minutes |

Results – Figure 17 - demonstrate that there is a slight difference in preference shares between Pingo Doce & Go Nova (47.6%) and Continente Labs (52.4%). This is on par with the suggestive conclusions of the mystery shopping experience, where the TAM score for Continente (78%) was higher than Pingo Doce's (63%). Nonetheless, the preference shares are very similar, which means that no specific player is a clear winner in terms of current service model.

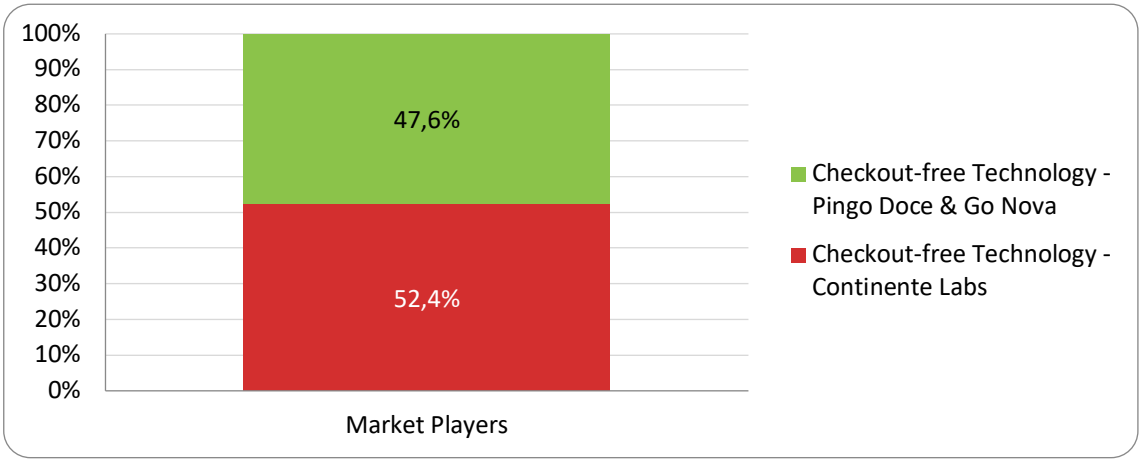


*Figure 17: Preference shares - Pingo Doce & Go Nova versus Continente Labs*

Moreover, both concept stores were compared to cashier lanes, and self-service machines – Figure 18. This process demanded an assumption related to time for checkout: as the technological level of the checkout method increases, the time for checkout will decrease. In other words, checkout-free technology assumes a time for checkout level of less than 3 minutes, self-service machines are 4 to 7 minutes, and cashier lanes are 8 to 11 minutes. This assumption translates the essential timesaving benefit of SSTs.

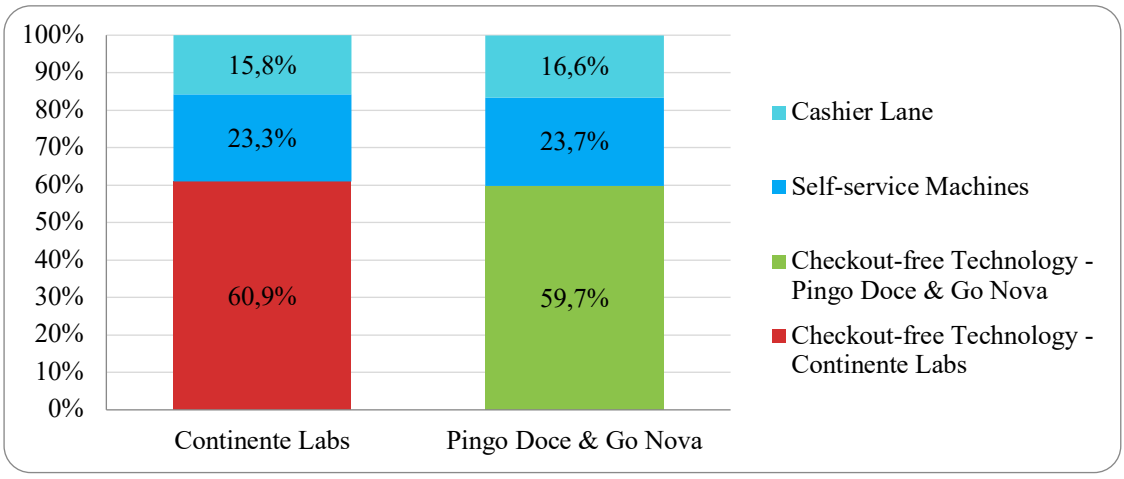


*Figure 18: Preference shares – the three checkout methods*

Checkout-free technologies own approximately 3/5 of consumers' preference share. As highlighted in previous sections, Portuguese consumers seem interested in the concept of checkout-free technologies, over the remaining checkout methods. However, the outcomes of the previous analyses conducted in this paper have offered significant evidence that this is not the case for consumers of all demographics, principally for older age ranges. Thus, new simulations were run, drawing a distinction between consumers in terms of age, ceteris paribus: a segment of consumers above the age of 45, and a segment below the age of 45 – Figure 19. In fact, checkout-free technology is the least preferred method for the older consumers, with a preference share 2.7 times smaller than the younger group.

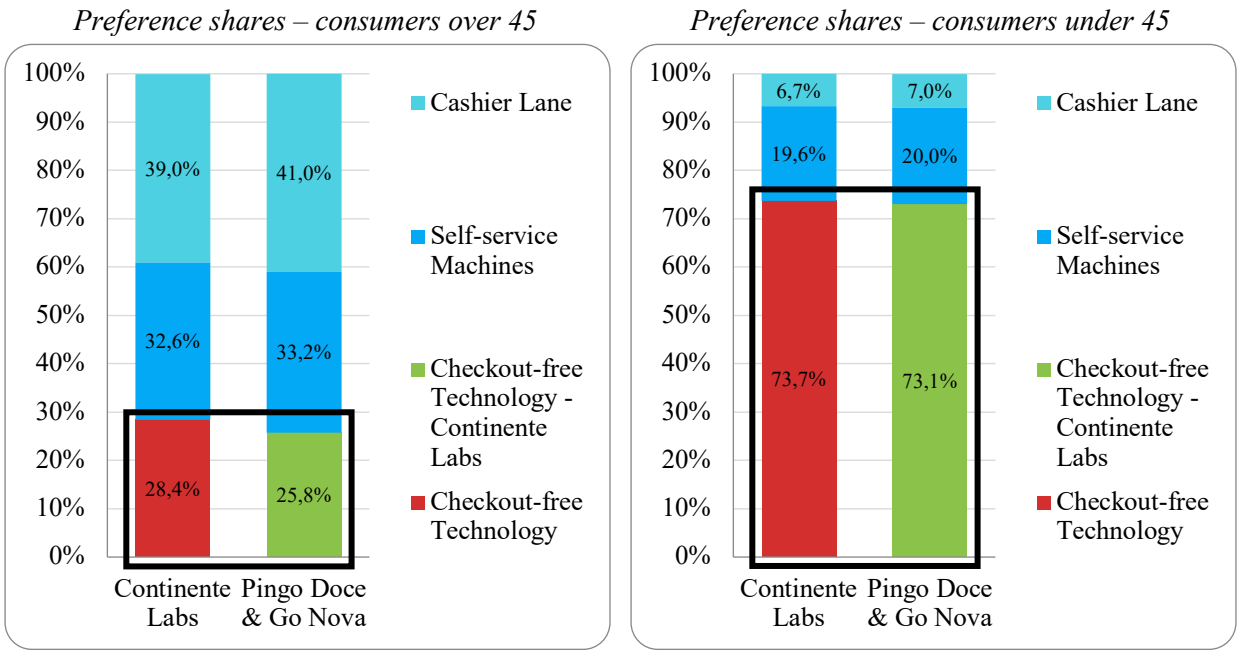


*Figure 19: Preference shares – the impact of age segmentation*

*i. What if analysis: entrance of new market player*

While the concept stores of Pingo Doce & Go Nova and Continente Labs are evidently appealing to the needs of younger consumers, earlier insights reveal that the service model of both stores does not match the ideal model profile. Partworth utilities determined that the following hypothetical combination of attribute levels is the most representative of consumer's preferences: less than 3 minutes for checkout; free of cost; medium interaction with employees; scanning your own products; paying with a card.

Against this background, a simulation was performed, assuming the scenario of the entry of a new market player (NMP) introducing checkout-free stores with an ideal profile service model – Figure 20. In this context, the NMP would register a preference share (72.3%) that is 12 percentage points higher than the average percentage share of the current market players (60.3%).

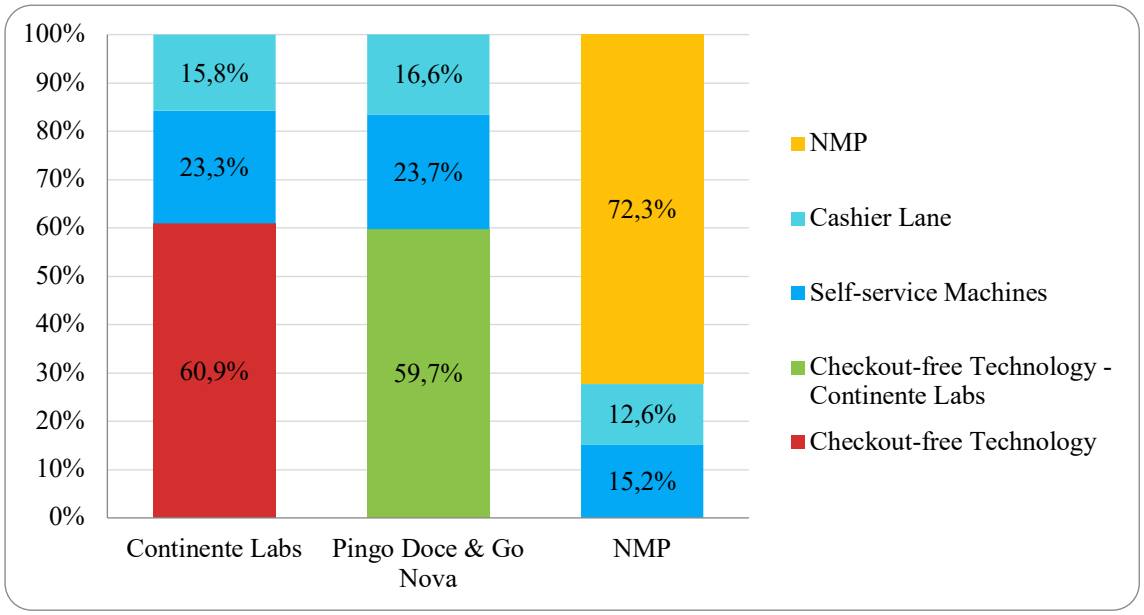


*Figure 20: Preference shares – entry of new market player*

These findings suggest that the two players in analysis should consider carrying out model adaptations, in order to achieve the best realizable performance in terms of preference share. Although the ideal profile determined that the preferred scanning method is the "scan your own products" approach, adaptations regarding the scanning method will not be considered, given its very low relative importance – Figure 14. Accordingly, the recommended adaptations are the following. First, Pingo Doce & Go should employ store assistants. The store's current concept model presumes that these are not necessary because all needed information can be accessed via the app (Expert Interviewee 1). However, analyses conducted earlier in the dissertation suggest that market players must employ store assistants in order to help consumers overcome expected feelings of technological anxiety when learning how to use checkout-free technology. Furthermore, in order to match the ideal combination of attribute levels, Pingo Doce & Go Nova and Continente Labs should remove the supermarket app as a necessary requirement to let shoppers visit their stores. In fact, partworth utilities have shown a drop in consumers' utility when forced to use a supermarket app. However, as previously discussed, the app is what currently offers retailers the ability to track shoppers at an individual level, so this would be against the essence of checkout-free stores and retailers' interests. In sum, the presence of store assistants at Pingo Doce & Go Nova is the only relevant recommended model adaptation.

*ii. What if analysis: NMP with a membership fee of 2.99€*

In order to withdraw conclusions related to the price sensitivity of consumers and potential added revenue sources for retailers, another simulation was performed. This test assumed that consumers could only visit the NMP under the condition of a monthly membership fee.

Figure 21 represents the preference share scenario of the NMP against the other methods of checkout. Earlier in this paper, results from the Willingness to Pay section revealed that Portuguese consumers are willing to pay up to 0.60€ to use checkout-free technology. In terms of levels, consumers are willing to pay 0.48€ to not use a supermarket app; 0.11€ to scan their own items; 0.17€ for employee interaction; and 0.65€ for the fastest check-out times. In total, this is 2.01€. Thus, the 14.1% preference share is foreseeable: it is understandable that a new market player could still compete with regular free of cost cashier lanes at the 2.99€ price point. However, a 5.99€ price point would not be financially feasible for retailers, given the preference share drop to 3.9% The price elasticity of demand between $2.99 and $5.99 is -2.1, meaning that demand is elastic: an increase in price by 1% leads to more than 1% drop in volume.

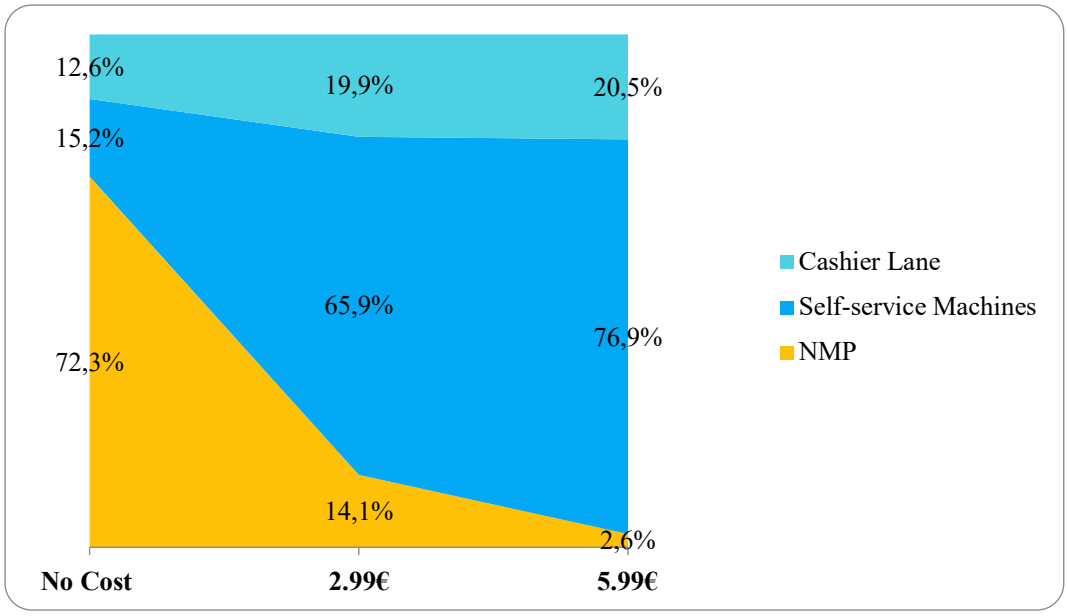


*Figure 21: Price sensitivity simulation*

Nonetheless, this simulation does not take into consideration the existing market players: Pingo Doce & Go Nova and Continente Labs. Therefore, lastly, a simulation was run comparing revenue projections for the hypothetical NMP against current players. This simulation is assuming a

pool of 1000 total shoppers, each spending 200€ in their checkout-free store of choice, by using the following formula:

Equation 3

$$Revenue\ Projection = share * membership\ price * 1000 + share * 1000 * 200€$$

The results in Figure 22 demonstrate that, in this scenario, the NMP would register a revenue of € 7.93K, which represents only 3.9% of the total revenue of the three players. Thus, although the 2.99€ price point seemed previously feasible, it would require all remaining players to adopt a similar monthly membership model.

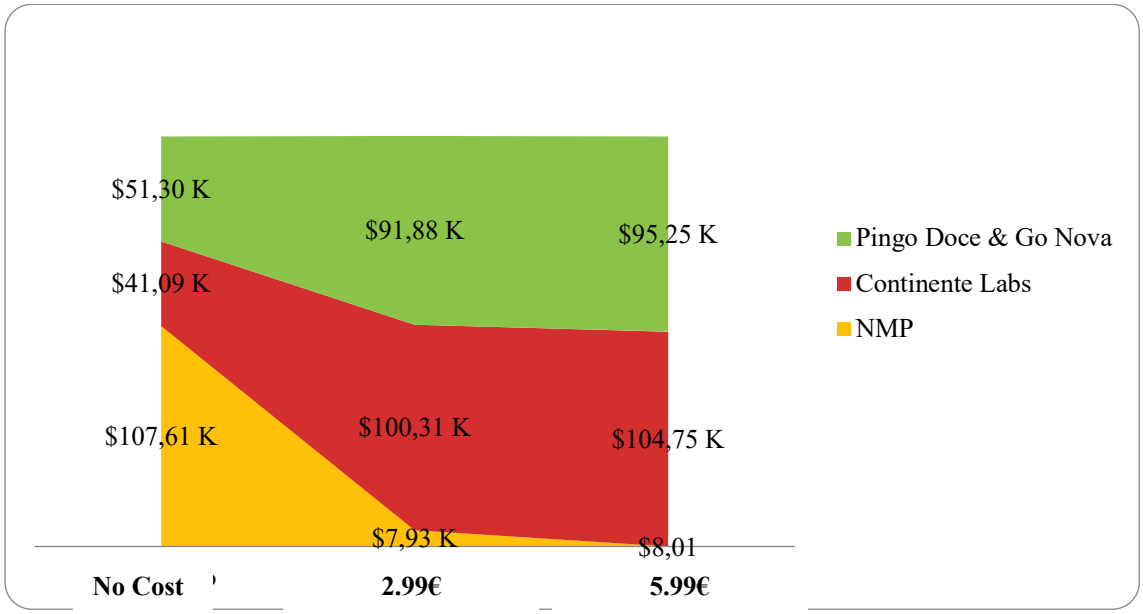


*Figure 22: Revenue projection simulation*

## 6. Conclusion

In today's world, everything happens faster and there is an unprecedented drive for efficiency. Processes are being optimized, and this trend is not only evident in the workplace but in all aspects of everyday life. Grocery shopping is no exception, as the focus is increasingly shifting toward a seamless consumer experience that can drive traffic back to retailers' physical stores. The supermarkets of the future "*will totally appeal to the five senses, with strong visual and olfactory components, and they will be thought of under two fundamental axes: technology and transparency with consumers"* (Indústria, 2018). New store concepts are emerging, and they can range from a self-checkout terminal to a completely automated supermarket. In order to better understand these trends, this Work Project evaluated how Portuguese consumers perceive the supermarket brands operating in the national market – Perceptual Mapping -, and which check-out methods they value the most – Conjoint Analysis.

First, the Perceptual Map analyses uncovered meaningful results. The top five market players, based on their most recent values of turnover, were studied through the lenses of the Brand Personality Construct. An ad-hoc approach to the model resulted in eight different brand personality dimensions: Sincerity, Excitement, Competence, Sophistication, Ruggedness (Aaker, 1997); Innovation (Su et al, 2015); Novelty, and Meaningfulness (Shams et al., 2015). The data collected was the target of a principal component analysis (PCA), where only one high-quality component (Eigenvalue > 1) was extracted. This component explained 96.851% of the variance in the dataset, and correlations between dimensions registered a minimum of 0.872. A second component was manually computed but registered an Eigenvalue very close to zero (0.205) and could only explain 2.566% of the variance in the model. The resulting component plot or perceptual map proved that brands are perceived quite distinctively from one another,but they are

compared in consumers' minds through one unidimensional construct – the unique factor originally extracted, which is argued to represent the perceived quality of the supermarket brand. Perceived quality can be described as a consumer's estimate of a product or service's cumulative excellence. Under this assumption, Continente is perceived as the highest quality brand, closely followed by LIDL and Pingo Doce. Auchan and Minipreço registered component 1 values below zero, meaning that they are perceived as the lower-quality brands in the group. Therefore, RQ1 (How do Portuguese consumers perceive supermarket brands operating in the national market?) is answered.

Against this background, an additional survey was constructed, in order to understand what are the drivers that mostly influence consumers' decision of what supermarket store to visit. It became evidently clear that Portuguese consumers are almost totally driven by functional values (89%) over hedonic ones (11%). Therefore, since brand-related drivers have low influential power, the relationship between Portuguese consumers and supermarkets can be described as transactional. This finding answers RQ3 (What are the drivers influencing what supermarket stores consumers shop at?). Moreover, statistical tests using this survey's data revealed that Portuguese consumers' perceptions of supermarket brand quality are not independent of the supermarkets that they most often visit. This means that a supermarket brand's perceived quality is influenced by functional values, such as store proximity.

One of the initial goals of this dissertation was to assess how a supermarket brand should position itself in the mental space of Portuguese consumers, in order to have the best chances at successfully implementing checkout-free technology in their stores. Thus, the link between the Perceptual Mapping and Conjoint Analyses was dependent on the successful extraction of, at least, two

factors for the principal component analysis (PCA). However, because consumers do not perceive supermarket brands multidimensionally, no conclusions can be extracted from independent brand personality dimensions, such as Innovation (Su et al, 2015); Novelty, and Meaningfulness (Shams et al., 2015). Consequently, a Multidimensional Perceptual Map addressing these dimensions was not realizable. Nonetheless, this is still a conclusion of value for players in the supermarket industry in Portugal. Retailers do not need to invest in repositioning themselves in the minds of Portuguese consumers to guarantee a successful introduction of checkout-free technology. On the other hand, the focus should be on transactional marketing objectives, connected to the functional values that drive consumer activity.

Given that the perceptions of Portuguese consumers have been established, the focus of the dissertation shifted toward their preferences: preferred checkout methods, and their respective attributes and levels. For the Conjoint Analysis, data was collected and exported through Conjointly, and then multiple analyses and statistical tests were performed. Results indicated that checkout-free technology is the preferred method for the general sample, with a partworth utility of approximately 50%. The cost of service is of very large importance for consumers (68.27%), followed by time for checkout (11.17%), payment method (11.17%), level interaction with employees (7.57%), and scanning method (3.70%). According to respondents' preferences, the ideal store profile is the following: less than 3 minutes for checkout; free of cost; medium interaction with employees; scanning your own products; paying with a card. In the remaining checkout methods, the results followed identical trends. Such insights offer a conclusion to RQ2 (What are the attributes that Portuguese consumers value the most in supermarket checkout methods?)

However, segmentation of the sample by age ranges drastically impacted the observed utility values. The previously mentioned partworth utility of approximately 50% for checkout-free technology drops to -42.66% when looking at Portuguese consumers above the age of 45. Thus, technology avoidance is a pertinent concept that influences the preferences of consumers in the older age segments. ANOVAs allowed for a better understanding of these results: this segment of consumers is specially not keen on installing a phone app to take advantage of this technology, and they place less value on the technology's inherent and central benefit of timesaving. Based on these findings, RQ4 is addressed (How does the age factor impact Portuguese consumers' interest in checkout-free technology?).

Nonetheless, two more analyses complemented the present dissertation: Willingness to Pay and Simulations. First, respondents registered a maximum willingness to pay of 2.01€. This means that, on average, Portuguese consumers would pay a membership fee of 2.01€ to shop at check-out-free supermarkets. However, the simulation analysis concluded that this could only be feasible if all players adopted a similar monthly membership model. If some remained free of charge, preference share, and consequently revenues, would transfer to the free stores. Simulations also revealed that, in order to maximize preference share, Pingo Doce & Go Nova should employ in-store assistants. Consumers indicate a preference for checkout-free stores without the requirement of a supermarket app. However, the app is what gives retailers the ability to track shoppers at an individual level, allowing for personalized marketing. Removing the app would be against the essence of checkout-free stores and retailers' interests, therefore, it is not a valid recommendation for model adaptation. This can strongly impact the external validity of the project's findings, because of the low representativity of the Portuguese population (Wild et al., 2022).

Limitations and Future Recommendations

First, it is important to consider that the number of total survey responses is quite low: 101 respondents in Survey 1, 103 in Survey 2, and 46 respondents in the complementary Survey 3. Furthermore, the over-sampling of university students resulted in a skewed sample, mainly in terms of respondents' age and qualification. This can impact the external validity of the work project's findings, because of the low representativity of the Portuguese population (Wild et al., 2022).

Regarding the Perceptual Mapping analysis, a relevant limitation is related to the fact that only a limited number of market players were studied. This means that, for certain survey participants, their favorite supermarket brand could have been left out of the player pool. Future research on the topic should expand this analysis to more brands.

Regarding the Conjoint Analysis, the main factor that limited the research was the complexity of the Conjointly platform. Its design fails to display accurately on smartphones, which led many participants to quit the survey. This explains the discrepancy between the registered 383 participants and 103 responses. The method also method becomes increasingly difficult to execute as the number of attributes and levels rises (Green & Srinivasan, 1990). Therefore, the 6 attributes and 19 levels in analysis can be challenging for low-resourced researchers.

Future studies on subjects similar to this Work Project's topic should address all limitations highlighted. As the industry steadily shifts towards more technological SSTs, new market conditions will continuously impact consumer behavior, perceptions, and preferences. Therefore, future research should build upon this dissertation's findings in order to further develop them and adapt them to upcoming market trends. The lack of literature on this subject also accentuates the need for adaptations of this research to new contexts, locations, and/or cultures.

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## 8. Appendices

Appendix 1 – Literature Review

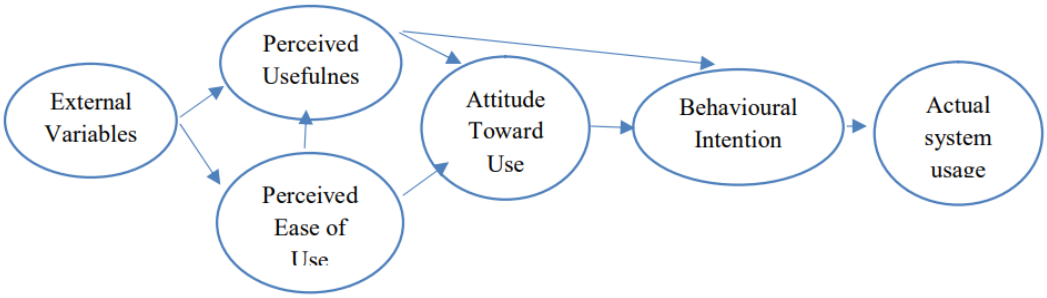



*Figure 1: The Technology Acceptance Model (Fred, 1985).*

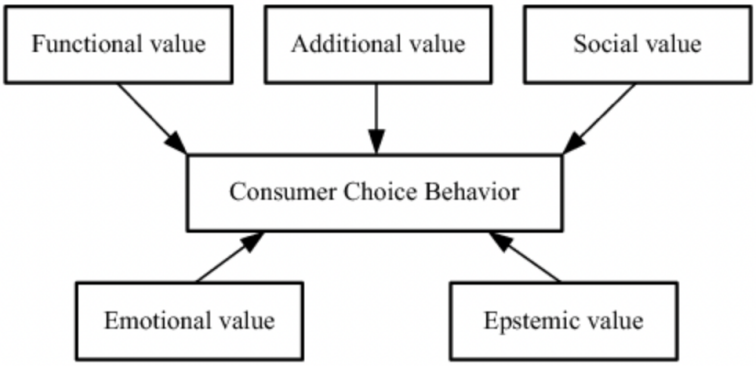



*Figure 2: Conceptual framework of the Theory of Consumption Values (Sheth, Newman, and Gross 1991).*

| **Brand Personality Dimension** | **Brand Personality Traits** |
|---|---|
| Sincerity | Welcoming, genuine, cheerful, honest, down-to-earth. |
| Excitement | Up-do-date, spirited, daring, imaginative. |
| Competence | Reliable, successful, determined. |
| Sophistication | Charming, upper-class. |
| Ruggedness | Strong, rugged, vigorous, tough. |
| Innovation | Unique, original, modern, intelligent, innovative, open to change.<br>(Su et al, 2015) |
| Novelty | Creative, different, trendsetter, surprising, forward-looking.<br>(Shams et al., 2015). |
| Meaningfulness | Useful, valuable, advantageous.<br>(Shams et al., 2015). |

*Table 1: Ad-hoc approach to the brand personality scale - the adapted model. Eight dimensions and their respective personality traits.*

Appendix 4: Mystery Shopping Results

| Shop-per | **Store Visited** | **De-mographics** | **PU Perceived Useful-ness** | **PEU Perceived Ease-of-Use** | **TAM** | **Experience Highlights / Additional Comments** |
|---|---|---|---|---|---|---|
| A | Continente Labs | 59-year-old male | 72% | 48% | 60% | Struggled with the app installation.<br>Managed to enter the store without the app/QR code, with the staff's help.<br>Performed the checkout through a self-service machine.<br>Experienced technical difficulties in payment. |
| B | Continente Labs | 23-year-old fe-male | 100% | 92% | 96% | Experienced technical difficulties with the app, namely with the app's link to a payment method, but was helped by the staff.<br>Overall, very positive experience. |
| C | Pingo Doce & Go Nova | 24-year-old male | 76% | 72% | 74% | Installation of the app was characterized as easy.<br>Experienced some difficulties when needing to remove an item from the app's shopping basket. |
| D | Pingo Doce & Go Nova | 52-year-old fe-male | 52% | 52% | 52% | Felt anxious before entering the store, because of the lack of confidence in operating with the technology, which resulted in an overall unpleasant experience. |

*Table1: Summarized results from Mystery Shopping Experience.*

Appendix 5 - Perceptual Mapping:

Survey Design

| **Supermarket Brand** | **Overall Turnovers (2021*)** | **Turnover in Portugal (2021*)** |
|---|---|---|
| **Pingo Doce** | $ 5.51 bn | $ 5.51 bn |
| **LIDL** | $ 75.10 bn | $ 2.10 bn |
| **Auchan** | $ 13.50 bn | $ 1.70 bn |
| **Continente** | $ 960 m | $ 960 m |
| **Minipreço** | $ 7.56 bn | $ 771 m |
| **El Corte Inglés** | $ 12.90 bn | $ 468 m |
| **Aldi** | $ 18.60 bn | $ 453 m |
| **Mercadona** | $ 28.50 bn | $ 416 m |

*Table 1: Turnover per supermarket brand - overall versus Portugal values. Source: Orbis, 2022. *Certain values are representative of the fiscal year of 2020.*

| Brand Personality Dimension | Brand Personality Traits |
|---|---|
| **Sincerity** | Welcoming, genuine, cheerful, honest, down-to-earth. |
| **Excitement** | Up-do-date, spirited, daring, imaginative. |
| **Competence** | Reliable, successful, determined. |
| **Sophistication** | Charming, upper-class. |
| **Ruggedness** | Strong, rugged, vigorous, tough. |
| **Innovation** | Unique, original, modern, intelligent, innovative, and open to change. (Su et al, 2015) |
| **Novelty** | Creative, different, trend-setter, surprising, forward-looking. (Shams et al., 2015). |
| **Meaningfulness** | Useful, valuable, advantageous. (Shams et al., 2015). |

*Table 2: Ad-hoc approach to the brand personality scale - the adapted model. Eight dimensions and their respective personality traits.*

| | Attribute | Description | Scale |
|---|---|---|---|
| Brand Personality<br><br>A brand's personality is described and measured by the human personality traits that are relevant to the brand. It is the set of human characteristics attributed to brands, for example, affectionate, funny, serious, or trustworthy. | Sincerity | Sincerity includes the following personality traits: welcoming, genuine, cheerful, honest, down-to-earth. | 1 – Lowest classification<br>4 – Highest classification<br>5 – "I do not know this brand" |
| | Excitement | Excitement includes the following personality traits: up-do-date, spirited, daring, imaginative. | 1 – Lowest classification<br>4 – Highest classification<br>5 – "I do not know this brand" |
| | Competence | Competence includes the following personality traits: reliable, successful, determined. | 1 – Lowest classification<br>4 – Highest classification<br>5 – "I do not know this brand" |
| | Sophistication | Sophistication includes the following personality traits: charming, upper-class. | 1 – Lowest classification<br>4 – Highest classification<br>5 – "I do not know this brand" |
| | Ruggedness | Ruggedness includes the following personality traits: strong, rugged, vigorous, tough. | 1 – Lowest classification<br>4 – Highest classification<br>5 – "I do not know this brand" |
| | Innovation | Innovation includes the following personality traits: unique, original, modern, intelligent, innovative, open to change.<br>(Su et al, 2015) | 1 – Lowest classification<br>4 – Highest classification<br>5 – "I do not know this brand" |
| | Novelty | Novelty includes the following personality traits: creative, different, trendsetter, surprising, forward-looking.<br>(Shams et al., 2015). | 1 – Lowest classification<br>4 – Highest classification<br>5 – "I do not know this brand" |
| | Meaningfulness | Meaningfulness includes the following personality traits: useful, valuable, advantageous.<br>(Shams et al., 2015). | 1 – Lowest classification<br>4 – Highest classification<br>5 – "I do not know this brand" |

*Table 3: Brand Personality Section: Attributes, descriptions, and scales.*

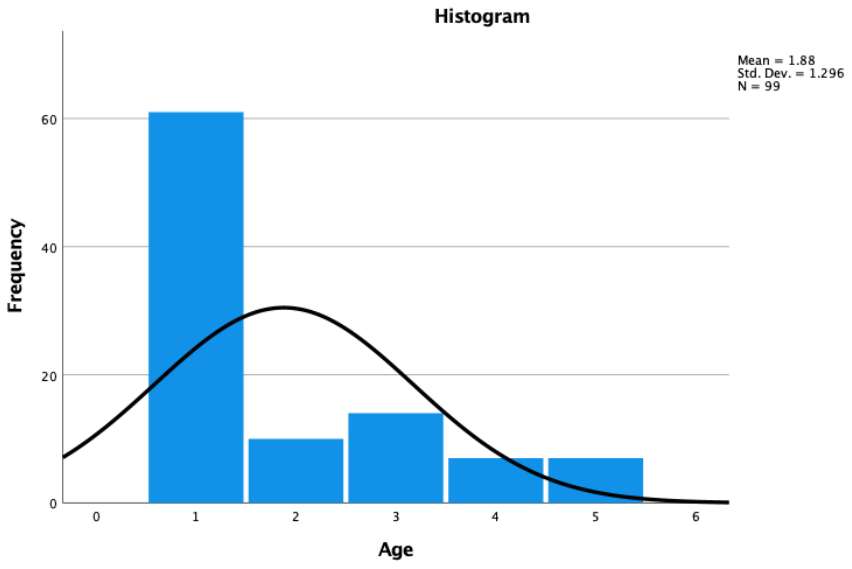
Sample Characteristics

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Other | 2 | 2,0 | 2,0 | 2,0 |
| | Portuguese | 99 | 98,0 | 98,0 | 100,0 |
| | Total | 101 | 100,0 | 100,0 | |

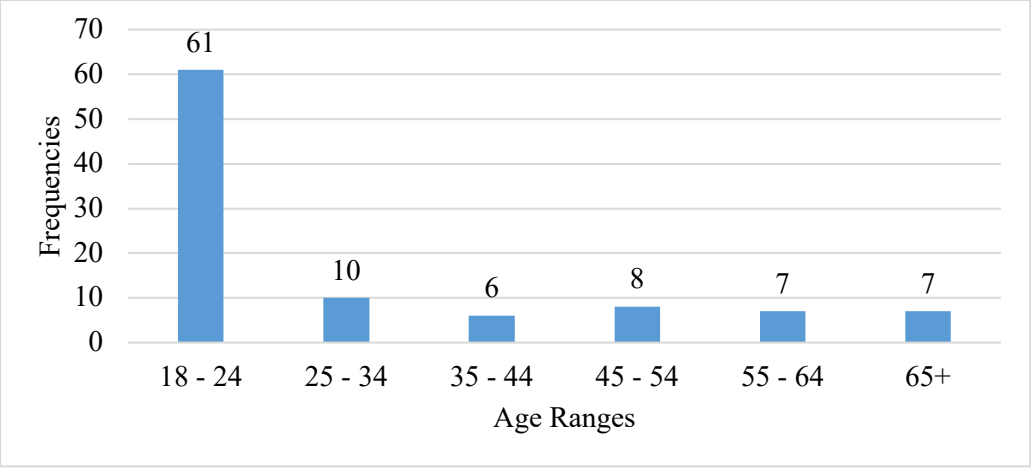
*Table 4: Number of respondents, divided by Portuguese and Non-Portuguese (N=101).*

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 18 - 24 | 61 | 61,6 | 61,6 | 61,6 |
| | 25 - 34 | 10 | 10,1 | 10,1 | 71,7 |
| | 35 - 44 | 6 | 6,1 | 6,1 | 77,8 |
| | 45 - 54 | 8 | 8,1 | 8,1 | 85,9 |
| | 55 - 64 | 7 | 7,1 | 7,1 | 92,9 |
| | 65+ | 7 | 7,1 | 7,1 | 100,0 |
| | Total | 99 | 100,0 | 100,0 | |

*Table 5: Age group percentage distribution (n=100).*




*Graphic 1: Histogram Age Group distribution.*




*Graphic 2: Age Group distribution.*

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Female | 58 | 58,6 | 58,6 | 58,6 |
| | Male | 39 | 39,4 | 39,4 | 98,0 |
| | Other | 2 | 2,0 | 2,0 | 100,0 |
| | Total | 99 | 100,0 | 100,0 | |

*Table 6: Gender percentage distribution (n=100).*

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | Center | 8 | 8,1 | 8,1 | 8,1 |
| | Algarve | 3 | 3,0 | 3,0 | 11,1 |
| | Azores | 1 | 1,0 | 1,0 | 12,1 |
| | Lisbon | 29 | 29,3 | 29,3 | 41,4 |
| | North | 58 | 58,6 | 58,6 | 100,0 |
| | Total | 99 | 100,0 | 100,0 | |

*Table 7: Portuguese region percentage distribution (n=100).*

| Annual Income Range* | PORDATA Results | Sample Results |
|---|---|---|
| Annual income of or below 10.999 | 30.9% | 39% |
| Annual income between 11.000€ and 19.999€ | 30.9% | 30.2% |
| Annual income between 20.000€ and 36.999€ | 23.6% | 17.1% |
| Annual income between 37.000€ and 74.999€ | 5.5% | 12.7% |
| Annual income above 75.000€ | 9.1% | 0.9% |

*Table 8: Comparison between sample results, from people who reported an annual income, and PORDATA's data. *The income ranges differ slightly between the two sources.*

Results and Discussion

| | Sincerity | Competence | Excitement | Sophistication | Ruggedness | Innovation | Novelty | Meaningfulness |
|---|---|---|---|---|---|---|---|---|
| Pingo Doce | 3.04 | 3.13 | 3.08 | 2.78 | 3.16 | 2.92 | 2.99 | 3.29 |
| LIDL | 3.33 | 3.29 | 3.40 | 2.81 | 3.29 | 3.33 | 3.45 | 3.45 |
| Auchan | 2.54 | 2.71 | 2.37 | 2.53 | 2.66 | 2.56 | 2.48 | 2.66 |
| Continente | 3.10 | 3.59 | 3.32 | 3.33 | 3.56 | 3.43 | 3.22 | 3.56 |
| Minipreço | 2.05 | 2.12 | 1.99 | 1.62 | 1.93 | 1.71 | 1.74 | 2.00 |

*Table 9: Perceptual Survey results: average dimension rating per brand.*

| | Sin-cerity | Compe-tence | Excite-ment | Sophisti-cation | Rug-ged-ness | Inno-vation | Nov-elty | Meaning-fulness |
|---|---|---|---|---|---|---|---|---|
| Sincerity | 1 | 0.935 | 0.984 | 0.872 | 0.951 | 0.963 | 0.996 | 0.975 |
| Compe-tence | 0.935 | 1 | 0.958 | 0.978 | 0.997 | 0.987 | 0.952 | 0.987 |
| Excitement | 0.984 | 0.958 | 1 | 0.882 | 0.962 | 0.964 | 0.981 | 0.983 |
| Sophistica-tion | 0.872 | 0.978 | 0.882 | 1 | 0.976 | 0.961 | 0.899 | 0.949 |
| Rugged-ness | 0.951 | 0.997 | 0.962 | 0.976 | 1 | 0.989 | 0.964 | 0.994 |
| Innovation | 0.963 | 0.987 | 0.964 | 0.961 | 0.989 | 1 | 0.982 | 0.986 |
| Novelty | 0.996 | 0.952 | 0.981 | 0.899 | 0.964 | 0.982 | 1 | 0.98 |
| Meaning-fulness | 0.975 | 0.987 | 0.983 | 0.949 | 0.994 | 0.986 | 0.98 | 1 |

*Table 10: SPSS Output - Correlation Matrix.*

| Cronbach's Alpha | Cronbach's Alpha Based on Standardized Items | N of Items |
|---|---|---|
| 0.994 | 0.995 | 8 |

*Table 12: SPSS Output - Reliability Analysis.*

| **Segment** | **Total Variance Explained by Component 1 (%)** |
|---|---|
| Gender: F | 96.417 |
| Gender: M | 95.514 |
| Age: 14 - 44 | 95.496 |
| Age: 45 + | 93.859 |

| | |
|---|---|
| Occupation: Student | 95.007 |
| Occupation: Employed | 95.807 |
| Occupation: Unemployed | 88.805 |
| Occupation: Retired | 86.71 |
| Income: 0 - 19.999€ | 97.014 |
| Income: 20.000€ + | 93.047 |
| Qualifications: until 9th grade | 92.904 |
| Qualifications: until 12th grade | 97.082 |
| Qualifications: BSc and above | 95.71 |
| Total Sample | 96.851 |
| Average | 94.10553846 |

*Table 13: SPSS Segmented Analysis.*

| | Component | |
|---|---|---|
| | 1 | 2 |
| Meaningfulness | 0.998 | -0.01 |
| Ruggedness | 0.995 | 0.091 |
| Innovation | 0.995 | 0.034 |
| Competence | 0.99 | 0.122 |
| Novelty | 0.985 | -0.15 |
| Excitement | 0.98 | -0.164 |
| Sincerity | 0.975 | -0.212 |
| Sophistication | 0.955 | 0.294 |

*Table 15: Dimension coordinates.*

| | Component | |
|---|---|---|
| | 1 | 2 |
| Pingo Doce | .34849 | -.28527 |
| LIDL | .74208 | -1.37216 |
| Auchan | -.45028 | .77269 |
| Continente | .88819 | 1.16603 |
| Minipreço | -1.52848 | -.28129 |

*Table 16: Brand coordinates.*

| Supermarket Brand | Average Score of all Dimensions | Score in % |
|---|---|---|
| Continente | 3.41 | 85% |
| Lidl | 3.27 | 82% |
| Pingo Doce | 3.03 | 76% |
| Auchan | 2.57 | 64% |
| Minipreço | 1.81 | 45% |
| Average | 2.818 | 70% |

*Table 17: Average Score of all Dimensions per Brand.*

Appendix 6: Additional Exploratory Survey - Drivers Influencing Supermarket Store Choice

| **Supermarket** | **Average Ranking** |
|---|---|
| Continente | 3,96 |
| Lidl | 3,72 |
| Pingo Doce | 3,43 |
| Auchan | 2,11 |
| Minipreço | 1,78 |

*Table 1: Average ranking per brand.*

| **Level of Significance ($\alpha$)** | **Critical Value** | **Q** | **Relationship** |
|---|---|---|---|
| 0.01 | 32.00 | 33.86 | Q > CV |
| 0.05 | 26.30 | 33.86 | Q > CV |
| 0.10 | 23.54 | 33.86 | Q > CV |

*Table 2: Summary of Contingency Analysis.*

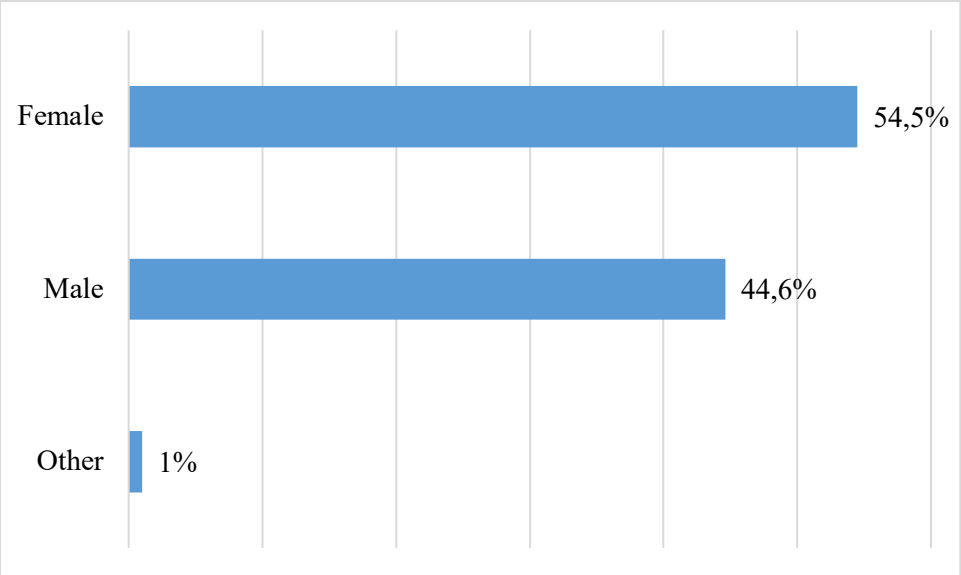
Appendix 7 – Conjoint Analysis

| Attributes & Levels / Brands | Checkout Free Technology | Self-Checkout | Cashier Lane |
|---|---|---|---|
| Payment Method | | | |
| Card | ✓ | ✓ | ✓ |
| Cash & Card | | ✓ | ✓ |
| Supermarket App | ✓ | | |
| Scanning of the products | | | |
| No scanning | ✓ | | |
| Self-scanning | ✓ | ✓ | |
| Cashier scanning | | | ✓ |

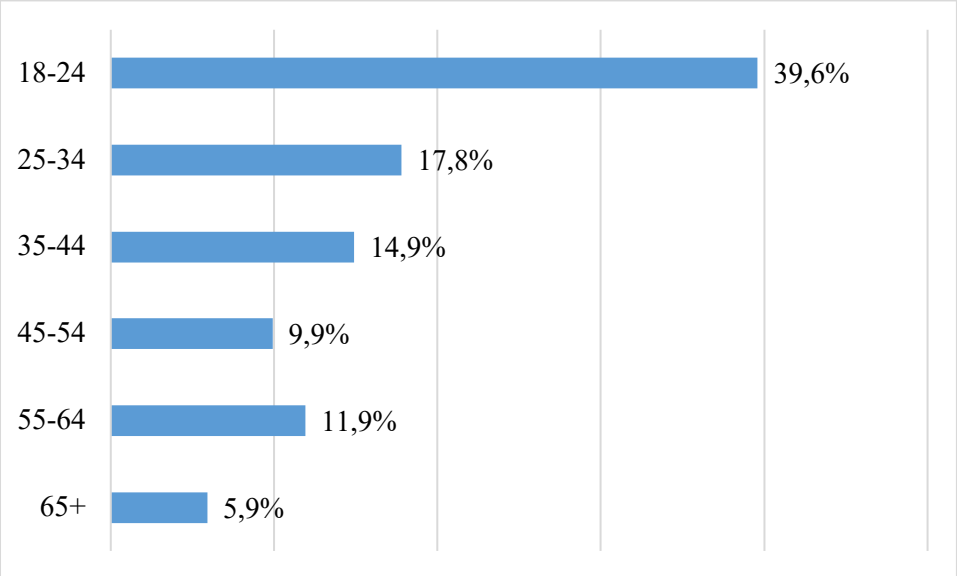
| | | | |
|---|---|---|---|
| Interaction with employees | | | |
| None to Low | ✓ | ✓ | |
| Medium | ✓ | ✓ | |
| High | | | ✓ |
| Cost of service | | | |
| No cost | ✓ | ✓ | ✓ |
| Monthly fee (2.99€) | ✓ | ✓ | ✓ |
| Monthly fee (5.99€) | ✓ | ✓ | ✓ |
| Time for Check-Out | | | |
| Less than 3 minutes | ✓ | | |
| 4-7 minutes | | ✓ | |
| 8-11 minutes | | ✓ | ✓ |
| 12+ minutes | | | ✓ |

*Table 1: Conjoint Analysis Construct: brands, attributes and levels*

Sample Characteristcs



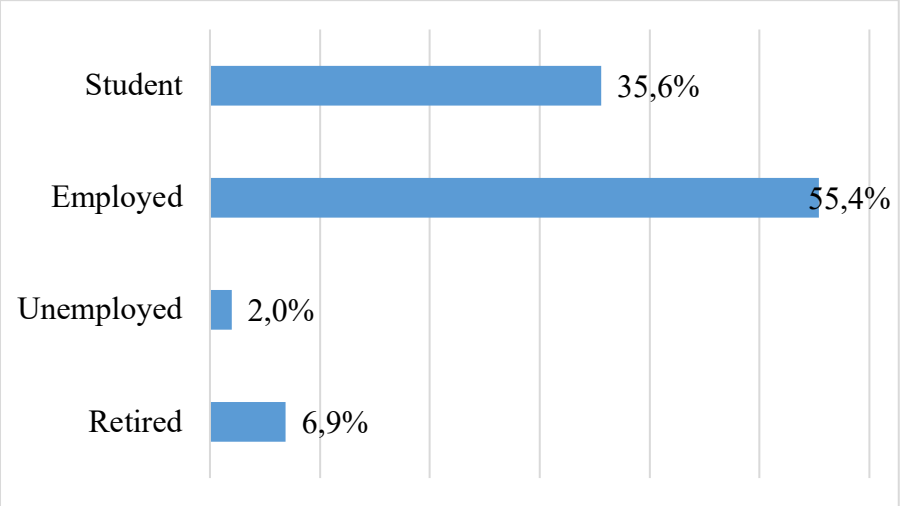

*Graphic 1: Sample Characteristic: Gender*



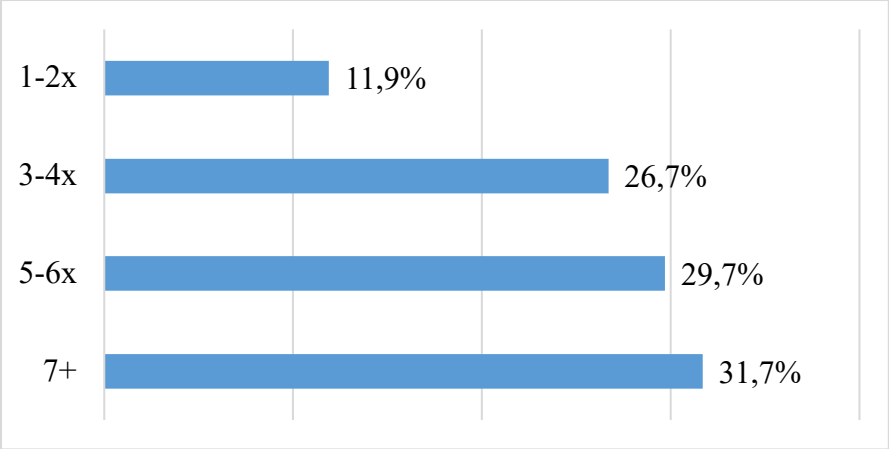

*Graphic 2: Sample Characteristic: Age*

| Annual Income Range* | PORDATA Results | Sample Results |
|---|---|---|
| Annual income of or below 10.999 | 30.9% | 9.9% |
| Annual income between 11.000€ and 19.999€ | 30.9% | 28.7% |
| Annual income between 20.000€ and 36.999€ | 23.6% | 11.9% |
| Annual income between 37.000€ and 74.999€ | 5.5% | 14.9% |
| Annual income above 75.000€ | 9.1% | 5.0% |

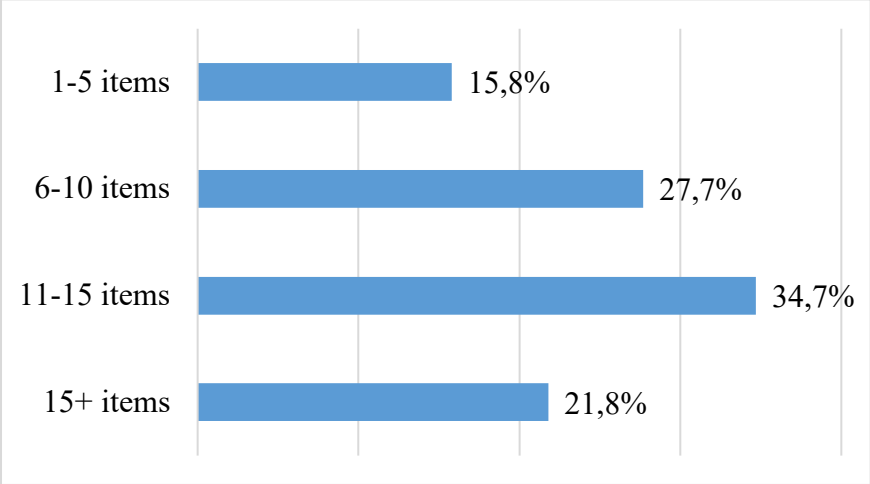
*Table 2: Sample Characteristics: Annual Income*




*Graphic 3: Sample Characteristic: professional status*




*Graphic 4: Frequency of monthly supermarket visit*

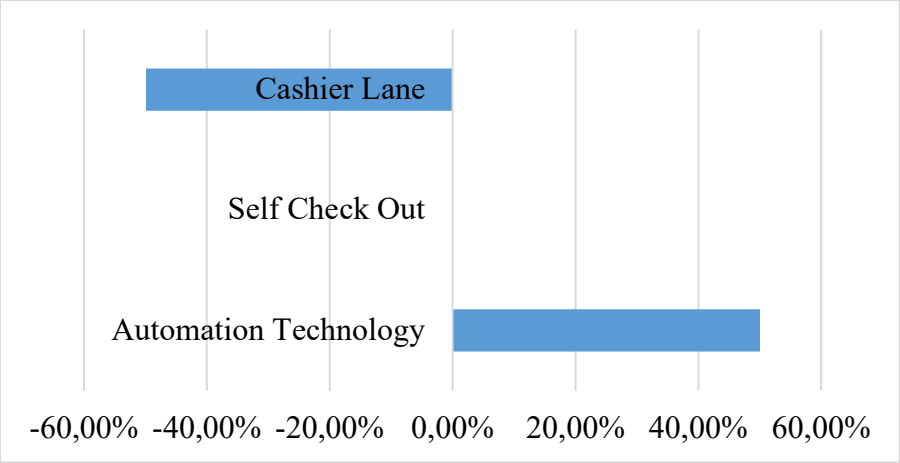



*Graphic 5: Number of items per supermarket visit*

## Results and Discussion

| | **Partworth Utility** | **Scaled Pathworth Utility** |
|---|---|---|
| **Checkout free technology** | 0.64 | 50.04% |
| **Self-checkout** | -0.00 | -0.08% |
| **Cashier Lane** | -0.64 | -49.96% |

*Table 3: Partworth Utilities for the Brand Attribute, for the entire sample.*




*Graphic 6: Partworth Utilities for the Brand Attribute, for the entire sample.*

| | | | | | | | | Partworth Utility | | | Scaling the Partworth Utility | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | n | Total n | Automation Technology | Self-Check Out | Cashier Lane | Max - Min | Automation Technology | Self-Check Out | Cashier Lane | Automation Technology | Self-Check Out | Cashier Lane |
| SEGMENT | Gender: F | 55 | 103 | 0 | -0,44 | -1,31 | 1,31 | 0,58 | 0,14 | -0,72 | 44.63% | 10.73% | -55.37% |
| | Gender: M | 47 | | 0 | -0,89 | -1,23 | 1,23 | 0,71 | -0,18 | -0,52 | 57.43% | -14.86% | -42.57% |
| | Gender: Other | 1 | | 0 | 0,47 | -1,38 | 1,86 | 0,30 | 0,78 | -1,08 | 16.31% | 41.85% | -58.15% |
| | Item per trip (<=10) | 45 | 103 | 0 | -0,73 | -1,25 | 1,25 | 0,66 | -0,07 | -0,59 | 52.71% | -5.42% | -47.29% |
| | Item per trip (>10) | 58 | | 0 | -0,57 | -1,29 | 1,29 | 0,62 | 0,05 | -0,67 | 48.04% | 3.93% | -51.96% |
| | Age (<=44) | 73 | 103 | 0 | -1,04 | -2,33 | 2,33 | 1,12 | 0,08 | -1,20 | 48.29% | 3.43% | -51.71% |
| | Age (>44) | 30 | | 0 | 0,40 | 1,41 | 1,41 | -0,60 | -0,21 | 0,81 | -42.66% | -14.68% | 57.34% |
| | Income: rather not say | 5 | 103 | 0 | -0,44 | 0,36 | 0,80 | 0,03 | -0,41 | 0,39 | 3.22% | -51.61% | 48.39% |
| | Income (until 19.999€) | 65 | | 0 | -0,57 | -1,41 | 1,41 | 0,66 | 0,09 | -0,75 | 46.75% | 6.50% | -53.25% |
| | Income (above 20.000€) | 33 | | 0 | -0,81 | -1,27 | 1,27 | 0,69 | -0,12 | -0,57 | 54.77% | -9.54% | -45.23% |
| | Supermarket trips per month (<5) | 40 | 103 | 0 | 0,02 | -0,29 | 0,31 | 0,09 | 0,11 | -0,20 | 28.05% | 35.97% | -64.03% |
| | Supermarket trips per month (>=5) | 63 | | 0 | -1,06 | -1,90 | 1,90 | 0,99 | -0,07 | -0,91 | 51.93% | -3.86% | -48.07% |
| | Professional status: student | 36 | 103 | 0 | -1,47 | -2,80 | 2,80 | 1,42 | -0,05 | -1,37 | 50.88% | -1.75% | -49.12% |
| | Professional status: employed | 58 | | 0 | -0,62 | -1,21 | 1,21 | 0,61 | -0,01 | -0,60 | 50.55% | -1.10% | -49.45% |
| | Professional status: unemployed | 2 | | 0 | 2,57 | -2,46 | 5,03 | -0,04 | 2,53 | -2,50 | -0.74% | 50.37% | -49.63% |
| | Professional status: retired | 7 | | 0 | 2,60 | 6,33 | 6,33 | -2,97 | -0,38 | 3,35 | -47.02% | -5.96% | 52.98% |
| | Qualifications: until 12th grade | 14 | 103 | 0 | 1,13 | 1,94 | 1,94 | -1,03 | 0,11 | 0,92 | -52.73% | 5.47% | 47.27% |
| | Qualifications: BSc and above | 89 | | 0 | -0,92 | -1,78 | 1,78 | 0,90 | -0,02 | -0,88 | 50.50% | -1.01% | -49.50% |
| | Region: North | 21 | 103 | 0 | -1,14 | -0,84 | 1,14 | 0,66 | -0,48 | -0,18 | 57.92% | -42.08% | -15.84% |
| | Region: Lisbon and Center | 76 | | 0 | -0,62 | -1,58 | 1,58 | 0,73 | 0,12 | -0,85 | 46.31% | 7.39% | -53.69% |
| | Region: South and Islands | 6 | | 0 | 0,83 | 1,12 | 1,12 | -0,65 | 0,18 | 0,47 | -57.99% | 15.99% | 42.01% |

*Table 4: Partworth Utilities: Sample Segmentation.*

| | | | Automation Technology | Self-Check Out | Cashier Lane |
|---|---|---|---|---|---|
| SEGMENT | **Gender: F** | 55 | 44.63% | 10.73% | -55.37% |
| | **Gender: M** | 47 | 57.43% | -14.86% | -42.57% |
| | **Item per trip (<=10)** | 45 | 52.71% | -5.42% | -47.29% |
| | **Item per trip (>10)** | 58 | 48.04% | 3.93% | -51.96% |
| | **Age (<=44)** | 73 | 48.29% | 3.43% | -51.71% |
| | **Age (>44)** | 30 | -42.66% | -14.68% | 57.34% |
| | **Income (until 19.999€)** | 65 | 46.75% | 6.50% | -53.25% |
| | **Income (above 20.000€)** | 33 | 54.77% | -9.54% | -45.23% |
| | **Supermarket trips per month (<5)** | 40 | 28.05% | 35.97% | -64.03% |
| | **Supermarket trips per month (>=5)** | 63 | 51.93% | -3.86% | -48.07% |
| | **Professional status: student** | 36 | 50.88% | -1.75% | -49.12% |
| | **Professional status: employed** | 58 | 50.55% | -1.10% | -49.45% |
| | **Qualifications: BSc and above** | 89 | 50.50% | -1.01% | -49.50% |
| | **Region: Lisbon and Center** | 76 | 46.31% | 7.39% | -53.69% |

*Table 5: SPSS Input for Descriptive Analysis.*

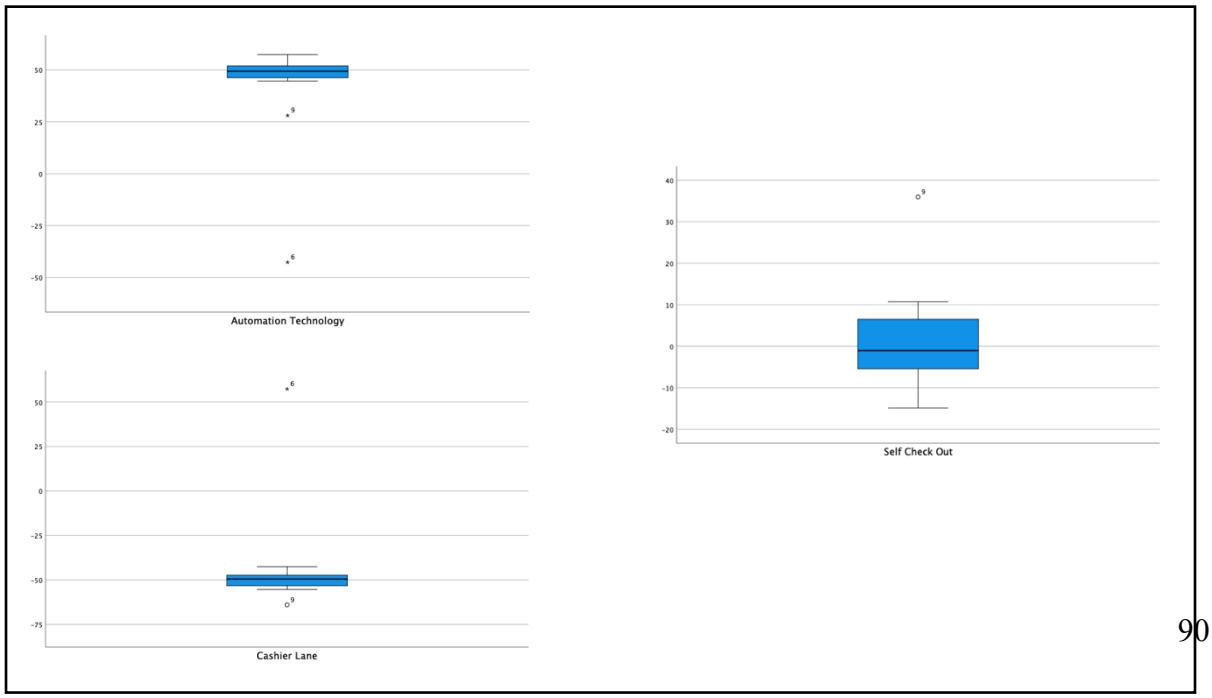
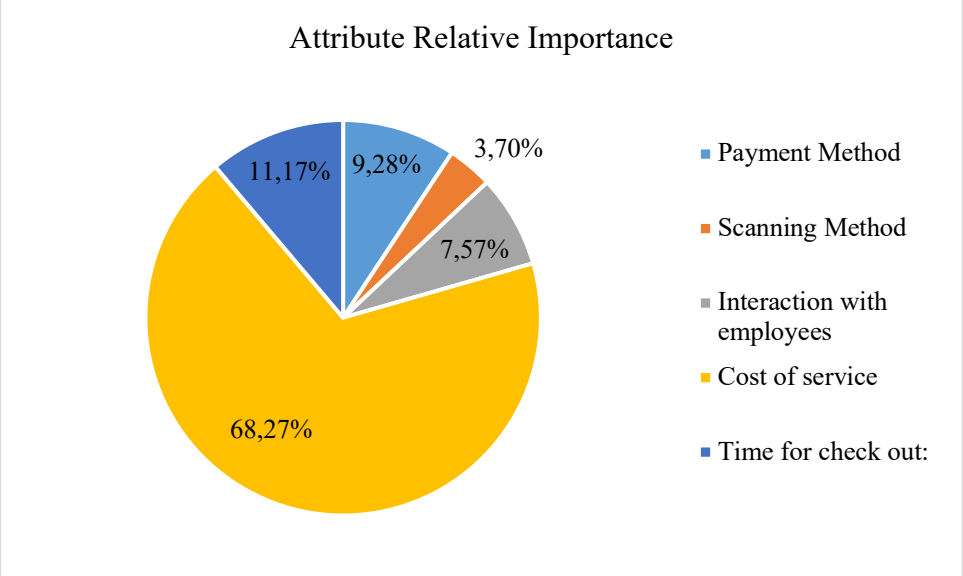



*Figure 1: SPSS Ouput: Outliers.*

| | Attribute Relative Importance |
|---|---|
| **Payment Method** | 9.28% |
| **Scanning Method** | 3.70% |
| **Interaction with employees** | 7.57% |
| **Cost of service** | 68.27% |
| **Time for check out:** | 11.17% |

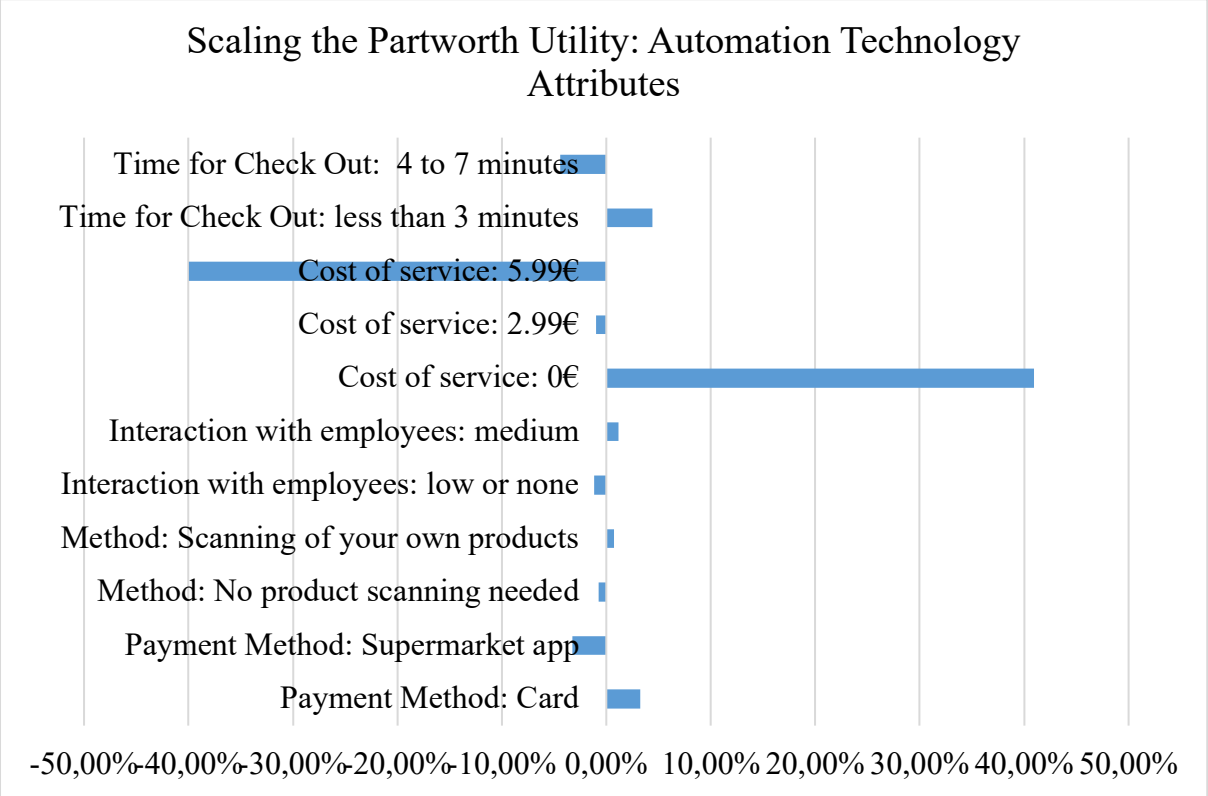
*Table 6: Attribute Partworths for automation technology.*




*Graphic 7: Attribute Partworths for automation technology.*

| | Partworth Utility | Scaling the Part-worth Utility | Ideal Profile |
|---|---|---|---|
| **Payment Method: Card** | 0,507 | 3.25% | Card |
| **Payment Method: Supermarket app** | -0,507 | -3.25% | |
| **Method: No product scanning needed** | -0,113 | -0.72% | Scanning of your own prod-ucts |
| **Method: Scanning of your own prod-ucts** | 0,113 | 0.72% | |
| **Interaction with employees: low or none** | -0,180 | -1.16% | Medium |
| **Interaction with employees: medium** | 0,180 | 1.16% | |
| **Cost of service: 0€** | 6,379 | 40.93% | 0€ |
| **Cost of service: 2.99€** | -0,149 | -0.96% | |
| **Cost of service: 5.99€** | -6,230 | -39.97% | |
| **Time for Check Out: less than 3 minutes** | 0,689 | 4.42% | Less than 3 minutes |
| **Time for Check Out: 4 to 7 minutes** | -0,689 | -4.42% | |

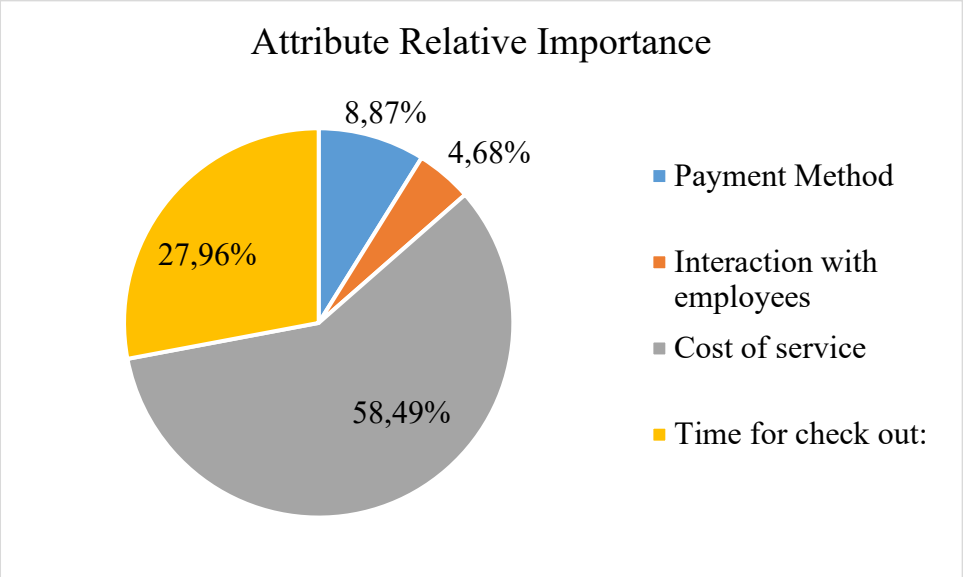
*Table 7: Level Partworths for automation technology.*




*Graphic 8: Level Partworths for automation technology.*

| | Attribute Relative Importance |
|---|---|
| **Payment Method** | 8.87% |
| **Interaction with employees** | 4.68% |
| **Cost of service** | 58.49% |
| **Time for check out:** | 27.96% |

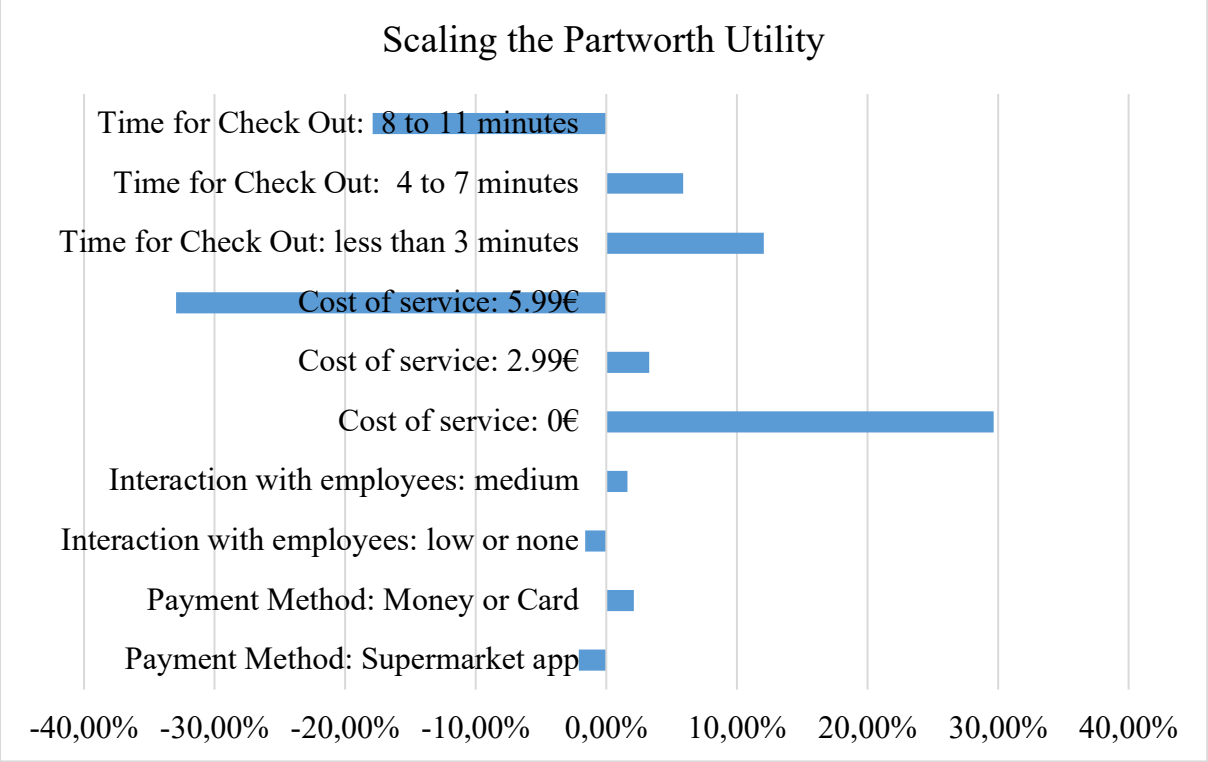
*Table 8: Attribute Partworths for self-check-out.*




*Graphic 9: Attribute Partworths for self-check-out.*

| | Partworth Utility | Scaling the Partworth Utility | Ideal Profile |
|---|---|---|---|
| **Payment Method: Supermarket app** | -0,459 | -2.10% | Money or Card |
| **Payment Method: Money or Card** | 0,459 | 2.10% | |
| **Interaction with employees: low or none** | -0,355 | -1.62% | Medium |
| **Interaction with employees: medium** | 0,355 | 1.62% | |
| **Cost of service: 0€** | 6,485 | 29.65% | 0€ |
| **Cost of service: 2.99€** | 0,721 | 3.29% | |
| **Cost of service: 5.99€** | -7,206 | -32.95% | |
| **Time for Check Out: less than 3 minutes** | 2,634 | 12.04% | Less than 3 minutes |
| **Time for Check Out: 4 to 7 minutes** | 1,284 | 5.87% | |
| **Time for Check Out: 8 to 11 minutes** | -3,918 | -17.91% | |

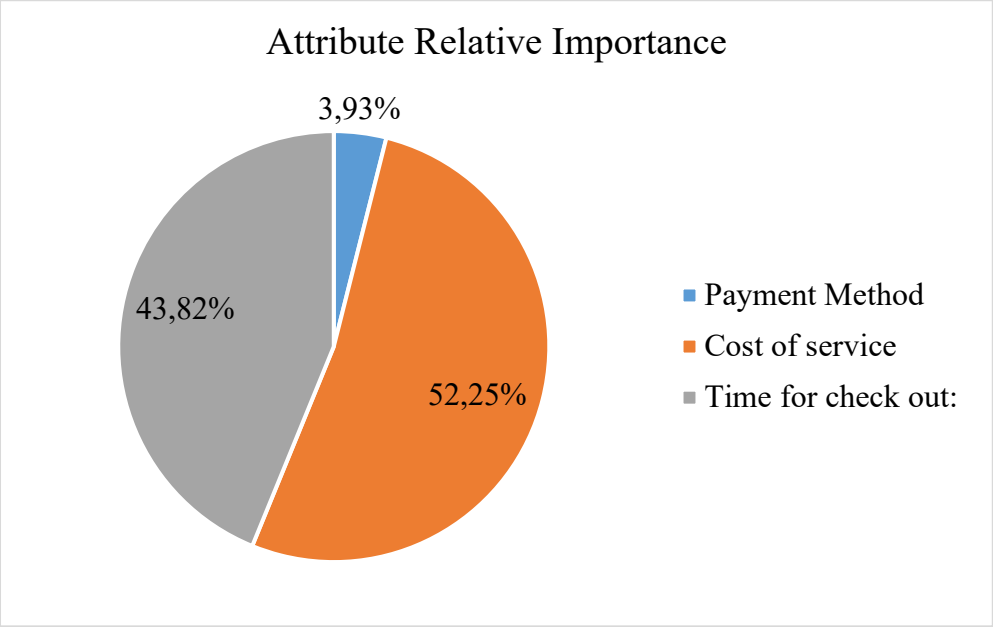
*Table 9: Level Partworths for self-check-out.*




*Graphic 10: Level Partworths for self-check-out.*

| | Attribute Relative Importance |
|---|---|
| **Payment Method** | 3.93% |
| **Cost of service** | 52.25% |
| **Time for check out:** | 43.82% |

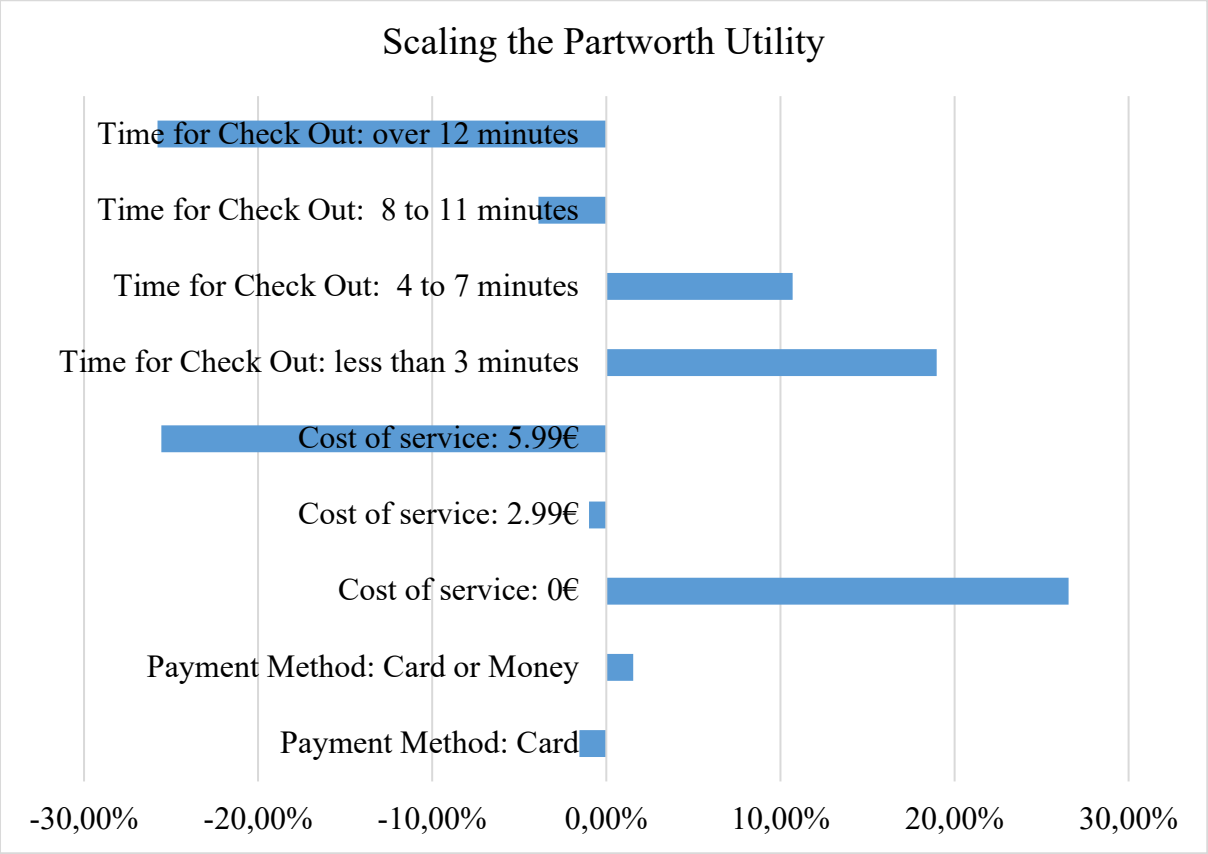
*Table 10: Attribute Partworths for cashier lane.*




*Graphic 11: Attribute Partworths for cashier lane.*

| | Partworth Utilities | Scaling the Part-worth Utility | Ideal Profile |
|---|---|---|---|
| **Payment Method: Card** | -0,353 | -1.56% | Card or Money |
| **Payment Method: Card or Money** | 0,353 | 1.56% | |
| **Cost of service: 0€** | 5,999 | 26.55% | 0€ |
| **Cost of service: 2.99€** | -0,227 | -1.01% | |
| **Cost of service: 5.99€** | -5,772 | -25.55% | |
| **Time for Check Out: less than 3 minutes** | 4,291 | 18.99% | Less than 3 minutes |
| **Time for Check Out: 4 to 7 minutes** | 2,416 | 10.69% | |
| **Time for Check Out: 8 to 11 minutes** | -0,880 | -3.89% | |
| **Time for Check Out: over 12 minutes** | -5,827 | -25.79% | |

*Table 11: Level Partworths for cashier lane.*




*Graphic 12: Level Partworths for cashier lane.*

| | | PAYMENT METHOD | SCAN-NING | EMPLOYEE IN-TERACTION | COST OF SERVICE | TIME FOR CHECK OUT |
|---|---|---|---|---|---|---|
| **PAYMENT METHOD** | Pearson Correlation | 1 | -0.107 | -.214* | -.377** | -.213* |
| | Sig. (2-tailed) | | 0.281 | 0.03 | <.001 | 0.031 |
| | N | 103 | 103 | 103 | 103 | 103 |
| **SCANNING** | Pearson Correlation | -0.107 | 1 | 0.186 | -.328** | 0.033 |
| | Sig. (2-tailed) | 0.281 | | 0.06 | <.001 | 0.737 |
| | N | 103 | 103 | 103 | 103 | 103 |
| **EMPLOYEE IN-TERACTION** | Pearson Correlation | -.214* | 0.186 | 1 | -.474** | -0.004 |
| | Sig. (2-tailed) | 0.03 | 0.06 | | <.001 | 0.972 |
| | N | 103 | 103 | 103 | 103 | 103 |
| **COST OF SER-VICE** | Pearson Correlation | -.377** | -.328** | -.474** | 1 | -.557** |
| | Sig. (2-tailed) | <.001 | <.001 | <.001 | | <.001 |
| | N | 103 | 103 | 103 | 103 | 103 |
| **TIME FOR CHECK OUT** | Pearson Correlation | -.213* | 0.033 | -0.004 | -.557** | 1 |
| | Sig. (2-tailed) | 0.031 | 0.737 | 0.972 | <.001 | |
| | N | 103 | 103 | 103 | 103 | 103 |

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

*Table 12: SPSS Output - Pearson Correlation of Attributes*

| | | | | RELATIVE IMPORTANCE (FOR AUTOMATION TECH) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | n | Total n | PAYMENT METHOD | SCANNING | EMPLOYEE INTERACTION | COST OF SERVICE | TIME FOR CHECK OUT |
| SEGMENT | **Gender: F** | 55 | 103 | 9.40% | 3.60% | 7.50% | 68.40% | 11% |
| | **Gender: M** | 47 | | 9% | 3.90% | 7.30% | 68.40% | 11.40% |
| | **Gender: Other** | 1 | | 14.80% | 3.70% | 21.10% | 50.90% | 9.50% |
| | **Item per trip (<=10)** | 45 | 103 | 8.30% | 3.40% | 7.90% | 70.20% | 10.10% |
| | **Item per trip (>10)** | 58 | | 10% | 3.90% | 7.30% | 66.70% | 12% |
| | **Age (<=44)** | 73 | 103 | 7.30% | 3.40% | 7.80% | 69.40% | 12% |
| | **Age (>44)** | 30 | | 14.40% | 4.40% | 6.90% | 65.30% | 8.90% |
| | **Income: rather not say** | 5 | 103 | 7.30% | 4% | 8.80% | 67.70% | 12.10% |
| | **Income (until 19.999€)** | 65 | | 10.30% | 4% | 8.30% | 66% | 11.40% |
| | **Income (above 20.000€)** | 33 | | 11.00% | 4.40% | 8.30% | 64.40% | 11.80% |
| | **Supermarket trips per month (<5)** | 40 | 103 | 9.50% | 4.10% | 7.50% | 68.50% | 10.40% |
| | **Supermarket trips per month (>=5)** | 63 | | 9.10% | 3.50% | 7.60% | 68.10% | 11.60% |
| | **Professional status: student** | 36 | 103 | 6.10% | 3.20% | 7.50% | 70.50% | 12.60% |
| | **Professional status: employed** | 58 | | 10% | 3.90% | 8% | 67.40% | 10.70% |
| | **Professional status: unemployed** | 2 | | 13% | 3.20% | 5.90% | 73.30% | 4.60% |
| | **Professional status: retired** | 7 | | 18.40% | 4.40% | 4.60% | 62.80% | 9.80% |
| | **Qualifications: until 12th grade** | 14 | 103 | 15.40% | 4.30% | 7.60% | 63.50% | 9.30% |
| | **Qualifications: BSc and above** | 89 | | 8.30% | 3.60% | 7.60% | 69% | 11.50% |
| | **Region: North** | 21 | 103 | 10.30% | 3.60% | 6.70% | 66.30% | 13.20% |
| | **Region: Lisbon and Center** | 76 | | 8.80% | 3.70% | 7.80% | 68.80% | 10.80% |
| | **Region: South and Islands** | 6 | | 11.60% | 3.60% | 7.20% | 69.10% | 8.50% |

*Table 13: Partworth Utilities - Sample Segmentation. Automation Technology*

| | | | RELATIVE IMPORTANCE (FOR AUTOMATION TECH) | | | | |
|---|---|---|---|---|---|---|---|
| | | n | PAYMENT METHOD | SCAN-NING | EMPLOYEE IN-TERACTION | COST OF SERVICE | TIME FOR CHECK OUT |
| SEGMENT | **Gender: F** | 55 | 9.40% | 3.60% | 7.50% | 68.40% | 11% |
| | **Gender: M** | 47 | 9% | 3.90% | 7.30% | 68.40% | 11.40% |
| | **Item per trip (<=10)** | 45 | 8.30% | 3.40% | 7.90% | 70.20% | 10.10% |
| | **Item per trip (>10)** | 58 | 10% | 3.90% | 7.30% | 66.70% | 12% |
| | **Age (<=44)** | 73 | 7.30% | 3.40% | 7.80% | 69.40% | 12% |
| | **Age (>44)** | 30 | 14.40% | 4.40% | 6.90% | 65.30% | 8.90% |
| | **Income (until 19.999€)** | 65 | 8.90% | 3.50% | 7.10% | 69.50% | 11% |
| | **Income (above 20.000€)** | 33 | 10.30% | 4% | 8.30% | 66% | 11.40% |
| | **Supermarket trips per month (<5)** | 40 | 9.50% | 4.10% | 7.50% | 68.50% | 10.40% |
| | **Supermarket trips per month (>=5)** | 63 | 9.10% | 3.50% | 7.60% | 68.10% | 11.60% |
| | **Professional status: student** | 36 | 6.10% | 3.20% | 7.50% | 70.50% | 12.60% |
| | **Professional status: employed** | 58 | 10% | 3.90% | 8% | 67.40% | 10.70% |
| | **Qualifications: BSc and above** | 89 | 8.30% | 3.60% | 7.60% | 69% | 11.50% |
| | **Region: Lisbon and Center** | 76 | 8.80% | 3.70% | 7.80% | 68.80% | 10.80% |

*Table 14: Partworth Utilities - Sample Segmentation. Automation Technology. SPSS Input.*

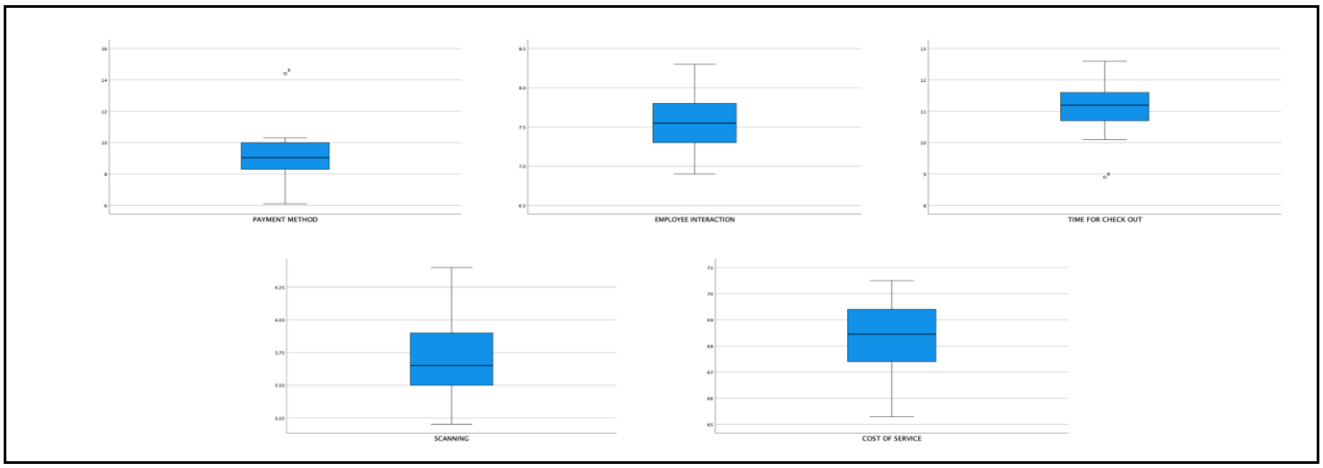



*Figure 2: SPSS Output: Outliers for Automation Technology.*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PAYMENT METHOD** | *Source of Variation* | *Sum of Squares* | *df* | *Medium SS* | *F* | *CV* | *p-value* |
| | Age | 0,133 | 1 | 0,133 | 54,508 | F>CV | 0,000 |
| | Error | 0,247 | 101 | 0,002 | | | p-value < 0,05 |
| | Total | 0,380 | 102 | | | | H0 is rejected, |
| **SCANNING** | *Source of Variation* | *Sum of Squares* | *df* | *Medium SS* | *F* | *CV* | *p-value* |
| | Age | 0,002 | 1 | 0,002 | 3,353 | F<CV | 0,070 |
| | Error | 0,074 | 101 | 0,001 | | | p-value > 0,05 |
| | Total | 0,076 | 102 | | | | Failed to reject H0, |
| **EMPLOYEE INTERACTION** | *Source of Variation* | *Sum of Squares* | *df* | *Medium SS* | *F* | *CV* | *p-value* |
| | Age | 0,002 | 1 | 0,002 | 0,695 | F<CV | 0,406 |
| | Error | 0,342 | 101 | 0,003 | | | p-value > 0,05 |
| | Total | 0,345 | 102 | | | | Failed to reject H0, |
| **COST OF SERVICE** | *Source of Variation* | *Sum of Squares* | *df* | *Medium SS* | *F* | *CV* | *p-value* |
| | Age | 0,043 | 1 | 0,043 | 4,444 | F>CV | 0,037 |
| | Error | 0,987 | 101 | 0,010 | | | p-value < 0,05 |
| | Total | 1,031 | 102 | | | | H0 is rejected, |
| **TIME FOR CHECK OUT** | *Source of Variation* | *Sum of Squares* | *df* | *Medium SS* | *F* | *CV* | *p-value* |
| | Age | 0,025 | 1 | 0,025 | 5,328 | F>CV | 0,023 |
| | Error | 0,469 | 101 | 0,005 | | | p-value < 0,05 |
| | Total | 0,494 | 102 | | | | H0 is rejected, |

*Table 15: ANOVAs for Age.*

| | Payment Method: Card | Payment Method: Super-market App | Scanning: No scanning needed | Scanning: Scan your own prod-ucts | Interaction with Employees: none or low | Interaction with Employees: av-erage | Cost of Service: Free | Cost of Service: 2.99€ | Cost of Service: 5.99€ | Time for Check Out: less than 3 minutes | Time for Check Out: 4 to 7 minutes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Partworth Utility** | 1,22 | -1,22 | -0,34 | 0,34 | -0,40 | 0,40 | 6,47 | 0,20 | -6,67 | 0,03 | -0,03 |
| **Scaling the Part-worth Utility** | 7.15 % | -7.15 % | -1.96 % | 1.96 % | -2.34 % | 2.34 % | 37.80 % | 1.15 % | -38.96 % | 0.18 % | -0.18 % |

*Table 16: Level partworths for people over 45 - Automation Technology.*

| Attribute | Level | Self-Check Out | Automation Technology | Cashier Lane | Averge Partworth Utility |
|---|---|---|---|---|---|
| **Cost of Service** | No cost | 0 | 0 | 0 | 0 |
| | €2.99 | -5,76 | -6,53 | -6,23 | -6,17 |
| | €5.99 | -13,69 | -12,61 | -11,77 | -12,69 |

*Table 17: Level partworths for Cost of Service amongst the check-out methods.*

| | Partworth Utilities | WTP |
|---|---|---|
| **Self-Check-Out** | -0,64 | €0.30 |
| **Cashier Lane** | -1,27 | €0.60 |
| **Automation Technology** | 0 | - |

*Table 18: WTP per check-out method.*

| | Partworth Utility | Scaling the Partworth Utility | Mean Utility | WTP |
|---|---|---|---|---|
| **Payment Method: Card** | 0,507 | 3.3% | 0,000 | |
| **Payment Method: Super-market App** | -0,507 | -3.3% | -1,014 | 0.48 € |
| **Scanning: No scanning needed** | -0,113 | -0.7% | 0,000 | |
| **Scanning: Scan your own prod-ucts** | 0,113 | 0.7% | 0,226 | 0.11 € |
| **Interaction with Employees: none or low** | -0,180 | -1.2% | 0,000 | |
| **Interaction with Employees: aver-age** | 0,180 | 1.2% | 0,361 | 0.17 € |
| **Cost of Service: Free** | 6,379 | 40.9% | 0,000 | |
| **Cost of Service: 2.99€** | -0,149 | -1.0% | -6,529 | |
| **Cost of Service: 5.99€** | -6,230 | -40.0% | -12,609 | 0.48€. |
| **Time for Check Out: less than 3 minutes** | 0,689 | 4.4% | 0,000 | |
| **Time for Check Out: 4 to 7 minutes** | -0,689 | -4.4% | -1,377 | 0.65 € |

*Table 19: WTP for attribute levels in automation technology*