Factors Affecting Technology Adoption: A study of the Smart Cart

Which factors can have an influence on the consumers' intention to adopt Smart Cart in Scandinavian Supermarkets?

Bachelor's thesis

Maria Zaki Sepideh A.-Broujerdi

Informatics
Bachelor's programme
13hp
Spring semester 2020
Supervisor: Dipak Surie

Factors Affecting Technology Adoption:
A study of the Smart Cart

Bachelor's Thesis

Zaki, Maria, It and Business, Bachelor's program, Malmö University, Sweden

A.-Broujerdi, Sepideh, It and Business, Bachelor's program, Malmö University, Sweden

Abstract

New technologies are constantly introduced in our everyday life. Societies and people have reaped great benefits from integrating information technology into a plethora of societal and commercial functions. However, innovations are not unconditionally accepted by users. Since digital innovations constantly are introduced to aid us, there is an interest in understanding what factors would either influence us or make us prone to adopt new technologies. The main research question is to identify the key influences, both positive and negative, within technology adoption. The scope was limited to Scandinavian supermarkets and the technology of adoption intention was the Smart Cart; a seamless approach to make your shopping experience easier. Through a value-based acceptance model (VAM), a quantitative survey was conducted to explore consumers, attitudes towards Smart Cart through the factors perceived usefulness (PU), perceived enjoyment (PE), perceived privacy risk (PPR) and perceived difficulty to use (PDU), in relation to the perceived value (PV) of the product which can eventually lead to intention to adopt and use(IAU). The findings showed that perceived usefulness (PU) and perceived enjoyment (PE) demonstrated a strong positive correlation to potential users' perceived value (PV) of Smart Cart while perceived privacy risk (PPR) showed a weak negative and perceived difficulty to use (PDU) showed a medium-strong positive correlation to potential consumers' perceived value (PV) of the product. Potential consumers' perception of Smart Cart's value (PV) showed a strong positive correlation with intention to adopt and use (IAU).

Keywords: Digital transformation, Smart Cart, Technology adoption, Technology acceptance model (TAM), Value-based adoption model (VAM)

Acknowledgments

We would like to thank our supervisor Dipak Surie for all your guidance and criticism which enabled us to improve our work and produce our possible best. We would also like to thank all of our respondents, without whom this study would not have been possible. Last but not the least, we would like to take this opportunity to thank our program director Carl-Johan Orre for your incredible support throughout the length of our study. It has been a pleasure to have you as our advisor and guide.

Malmö, 2020-06-04

Maria Zaki & Sepideh A.-Broujerdi

Table of Contents

1 Introduction

1.1 Background

In the 1990s companies had access to a vast amount of funding for new information technology, which led to million-dollar investments in sophisticated software packages, websites, and other digital technologies (Andal-Ancion, Cartwright & Yip, 2003). These investments helped the companies to stay in the game alongside their competitors, that were making similar kinds of investments (Andal-Ancion et al., 2003).

Firms from all fields started investing more and more in information system hardware, software, and telecommunication equipment (Laudon & Laudon, 2018). The primary objective here was to achieve a competitive advantage in the market by enhancing the firms' performance by using information technology. The second objective, that was intended to be achieved, was to better equip the firm by redesigning firms' business operations so that they could take advantage of the emerging technologies (Laudon & Laudon, 2018). Digital Technologies that can include collaborative technologies, internet of things and mobile technologies can contribute to enhancing a company's performance (Henriette, Feki & Boughzala, 2016). In an interview with Karin Lindström (2018, November 2), Akademibokhandelns CIO Anna-Lena Olsson said that digitalization in a firm could range from using the new techniques in businesses to logistical support and further to creating better experiences. It was all about *creating better value for customers* and using information technology in business practices could facilitate that objective (Lindström, 2018, November 2).

To implement technologies that will create better value for customers, there are a few things to take into consideration. What the retail market will look like in the future depends to a large extent on consumer behavior and the ability of stores to adapt to the market. There is no doubt that the most successful physical stores are the ones that are developing and implementing digitalization to create unique customer experiences (Lemon & Verhoef, 2016). With the increased competition from e-commerce, classic brick and mortar shops need to find new ways to attract customers. According to Charles Ingene (2013), there are a few factors to take into consideration that have changed the landscape historically . Factors such as logistics and urbanization have contributed to the way retail is seen today, and will most likely continue to do so, and the technology has to change with the development in our society (Ingene, 2013).

An example is how urbanization has affected retail stores in Sweden. The amount of retail stores decreased from 39 000 stores in 1950 to just 6 900 in 1997; although the amount of bought goods increased immensely during this period of time (Kärrholm & Nylund, 2011). There are different areas where digitalization could be beneficial in retail to keep up with the ever-changing environment. Behind the scenes, IT-solutions help the boutiques keep record of their inventory, stay connected to their employees, using business intelligence to foresee trends eg. For the customers, there has been some changes in the shopping experience, aside from the resulting effects that come with a better-organized store due to IT-solutions.

The introduction of card payments simplified the shopping experience for customers. According to a survey from 2018 initiated by Riksbanken, 80% of the participants said that they used a bank card in their last purchase. Only two years earlier the amount was only 64%. Even though cash payment has decreased, it is still pertinent in Sweden with 6 out of 10 saying they used cash in the last month (Riksbanken, 2018). When it comes to preferred ways of shopping, it is noticeable that self-scanning in commodity markets has increased during the last years. According to a survey done by Sifo, 6 out of 10 opted for a self-scanning solution while shopping. Some boutiques allow the customer to scan their goods with their own cell phone. Only 2% said that they have used this function, however, 64% of the participants said that they were feeling positive about this solution (Visma, 2017).

Figure 1. Self-checkout scanner[1] *(ICA, n.d.)*

Even though new technologies are being introduced to simplify the shopping experience, non-technological methods are used in parallels, such as cash payments and conventional conveyor belt shopping. This could be explained by the Diffusion of innovation-model (Rogers, 2003). This model categorizes the population in 5 different groups where we have *innovators*, who adapt to new technology quickly, followed by *early adopters*, *early majority*, *late majority,* and *laggards*. The new innovation can harvest more market shares when more people adapt to new technology. Rogers (2003) argues that there are four ways of catalyzing new innovations: innovation by itself, time, how the innovation is communicated, the channels which are used and a social system.

As far as the retail industry is concerned, it can be considered an ever-changing environment and new technology is steadily implemented in all kinds of functions. One such emerging technology is *Smart Cart* which allows the customers to have a comparatively easier and fun-filled shopping experience (Smartcart, n.d.). The Smart Cart will automatically register the goods you put in it and via inbuilt screen, your phone, or iPad you can complete your payment. Besides the payment function, the customer has access to other functions as well while shopping. The customer can keep a grocery list in the application and general preferences, food recipes eg. and the application will guide you through the store depending on the inserted information. It offers intelligent shopping cart solutions for retail and grocery trade which can consequently update the shopping experience to the digital era (Smartcart, n.d.).

[1] *The copyrights for the figure belong to the copyright owner. An email has been sent to request approval and currently awaiting response.*

Figure 2. Smart Cart (smartcart, n.d.).

The financial situation has changed since the 1990s and many companies do not have the same kind of investments at their disposal as they once had. As the companies have limited funding, they want to be extremely careful about where they invest and which new technology they choose (Andal-Ancion et al., 2003). The recent years have seen a number of initiatives taken by all types of companies to explore the new information technologies and their potential benefits (Matt, Hess & Benlian, 2015). The cost alone might not be the reason why businesses are reluctant to try new techniques. If there is a possible profit in implementing smart retail, surely businesses would be interested. However, this is solely not linked to a single factor, but a complex consolidation of both micro/macro-perspectives such as the maturity of the market as mentioned before with the diffusion innovation model.

1.2 Problem Discussion

As the funding has decreased and the screening process by companies for new technologies has increased, it has become more important to understand how the new technology, in this case the Smart Cart, will work and also to explore the benefits and challenges that the adoption of this new technology will likely present. Even when the new digital technologies are transforming all businesses regardless of their scale, limited consideration has been given to the potential upcoming challenges (Heavin & Power, 2018).

In this thesis, we try to understand the customer's perspective in order to aid in enhancing the company's profits. Afterall, the company can only make profit if their technology is actually adopted by the users. And the users will only adopt it if the technology is creating some kind of value for them. And that's why we are trying to understand " what factors will create value for the customers so that they eventually adopt?". If a company knows beforehand which factors work and which can pose a potential hindrance, they can work extra on those before launching the technology to make sure that customers adopt and the company can make profit.

1.3 Goal

With keeping the problem discussion in focus, the purpose of this thesis is to explore the factors that can have an influence on the customers intention to give the technology a chance and finally decide on using it. The identified factors can also be used as an aid by companies

who are intending to introduce and implement this kind of technology. This study can also lead to better deployment of resources by companies as the identified factors can highlight the positives as well as the challenging areas that need to be focused on. Furthermore, this study can also contribute as a foundation in further research of Factors affecting technology adoption which can, in turn, provide organisations with tools to realize a smoother transition.

1.4 Research Question

Which factors can have an influence on the consumers' intention to adopt Smart Cart in Scandinavian Supermarkets?

1.5 Disposition

This thesis is divided into three sections. The first section offers a literature overview of Digital Transformation, Questions about Data collection and privacy risks and finally of the Smart Cart. Then, it provides the conceptual model and the hypothesis for the study. The second section presents the methodology and the results. In the last section, the results of the research are discussed and eventual suggestions for future research are provided.

2. Theoretical Background

2.1 Digitalisation and Digital Transformation

The term digital transformation can often be given the same meaning as digitalisation, but experts stress the importance of separating them (Brennen & Kreiss, 2016). Digital transformation can differ depending on its context such as company, industry and field of application. Often, in the concept of digital transformation, more parts of the business are interwoven and affected compared to the digitalisation of an execution or process. I.e. behaviour change, skills development and other business activities. Essentially, digital transformation can be defined as the integration of digital technology in all parts of a company that leads to a change in how the company works and delivers value to its customers (Brennen & Kreiss, 2016).

Digitalisation is thus defined as the process whereby we change our way of working and our structures whereas digital transformation is defined as the total influence it has on our society or in our organisation.

In this context, digitalisation continuously has a huge impact on the retail industry and has initiated several phases of digital transformation. The deployment of e-commerce has changed the need for brick-and-mortar stores, yet it has its limitations (Piotrowicz & Cuthbertson, 2014). Online stores still have not been able to utilise all five senses of the consumer, thus making physical retail stores valuable in tailoring the consumer journey. This affects the role of the traditional in-store technology and creates a need for complex technology in physical stores and digital transformation in the retail industry (Piotrowicz & Cuthbertson, 2014). Specifically, there is a need for more interactive innovations rather than simple technology, like self-scanning, which merely aims to improve operational procedures.

2.2 Privacy Risks

In a period of rapid technological development, the question of personal integrity has become increasingly important. More than ever customer information is requested and provided to companies, which exposes the providing customer to greater privacy risks. Featherman, Miyazaki & Sprout (2010) state that financial and health-related services are especially exposed as they transmit and store a great amount of sensitive and confidential information. These risks may include, but are not limited to identity theft, financial fraud, phishing, stalking, hacking, etc. (Liao, Liu & Chen, 2011). Naturally, these potential privacy breaches leave room for customer concern with the possibility of inhibiting technology adoption (Xu & Gupta, 2009).

According to Kumar and Reinartz (2018), customer privacy concerns emerge from and can be divided into three primary dimensions. The company's *collection* method of customer information, the extent to which the customer can *control* this information, and the degree to which the customer possesses *awareness* of the company's privacy condition and practice.
These three sources of privacy concern can be heightened furthermore if customers worry about their information in terms of error, improper access and unauthorized secondary use (Kumar & Reinartz, 2018).

Other than reducing the privacy risk, addressing the customers' privacy concern can facilitate technology adoption (Featherman et al., 2010). According to previously conducted research, there are two main counterweights to manage privacy concerns and reduce the perception of privacy risk (Featherman et al., 2010; Inman & Nikolova, 2017).

One of such counterweights is business or brand credibility. New technologies are less likely to be adopted by customers, if the company behind the technology is deemed unsafe or untrustworthy. Therefore, reputable companies are perceived to have a competitive edge (Inman & Nikolova, 2017). Secondly, privacy-invading technologies increase privacy concerns, but can be outweighed if the benefit exceeds the sacrifice, i.e. the consumer values the technology to be worth the risk. This comparison is conceptually often regarded as a *privacy calculus* by researchers (Posner, 1981; Smith, Dinev & Xu, 2011).

2.3 Smart Cart

Smart Cart can be classified as "a personal shopping assistant", and it allows the customers to have a comparatively easier and fun-filled shopping experience (Smartcart, n.d.). The Finnish version of smart shopping cart is a seemingly normal shopping cart with a screen like a tablet attached, though there are other variants with the option of using the shopper's own device. As for payment, the shopper can complete the payment through the use of a smartphone, tablet or the Smart Cart's own screen, which eliminates the need to wait in any queue. Registering the items is a part of putting the items in the smart shopping cart will register items and the shopper has access to a number of other functions at the tip of their finger while shopping. These functions allow the shopper to keep a grocery list, add general preferences and look up food recipes in the application. Furthermore, the cart has a designed and interactive guidance throughout the store layout to aid with product location, product info, store info and even provides suggestions based on the location in the store (Smartcart, n.d.).

As of now, there are different variants of the cart appearance and functionality, but this study focuses on the Finnish version as it is deemed more comparable to environmental requirements within Scandinavia.

2.4 Technology Acceptance and Adoption Models

2.4.1 Reviewed Theories

The following theories and models were reviewed, yet not chosen for the scope of this study.

Diffusion of Innovation Theory created by Everett M. Rogers (2003) aims to explain the adoption or potential non-adoption of an innovation within a given time. More specifically, the focus relies heavily on how, why and at what rate an innovation is adopted within a system of users. The theory categorises users depending on when they adopt a new idea or technology and subsequently seeks to identify the point where an innovation has reached the so-called critical mass (Rogers, 2003).

This study, however, is aiming to explore the potential future users' intention to adopt the Smart Cart, rather than dividing them into segments within an adoption framework and

timeline. Since Smart Cart is a new innovation, it has yet to gain momentum and diffuse. Thus, Rogers' theory has been omitted from our study.
Theories dominant within psychology, education, and communication such as **Theory of Planned behaviour**, **Theory of Reasoned Action**, **Motivational Theory**, and **Social Cognitive Theory** have been rejected. This ruling is on the grounds that technology usage has not been sufficiently prominent within these theories and models for our study specifically.

2.4.2 Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) evaluates users' acceptance of technology. The model was developed by Davis, (1989) and has a two factor approach *perceived usefulness* and *perceived ease of use* as shown in figure 3. These two factors combined or separately affect the *attitude toward using* a certain technology, which in turn affects the user's *behavioral intention to use* the technology. The model is derived from **Theory of Reasoned Action** (TRA) and **Theory of Planned Behavior** (TPB), but it is acknowledged that TAM consistently outperformed both predecessors in studies, as the model combines traits from both models (Bagozzi, 2007).

It is known as a validated model within technology acceptance, but looks primarily at acceptance by users in an organizational context (Mani & Chouk, 2017). Therefore, the model bases on the understanding that the technology in question is mandatory and adds no additional cost to the user since it is required by the organisation.

It has received criticism as it assumes that individuals plan their behaviour, their rationale and their actions (Rauniar, Rawski, Yang, & Johnson, 2014). A limitation of this model is that the ease of use is defined by the user's subjective perception depending on their age, generation, their experience, age, gender and other distinguishing attributes. The same piece of technology is perceived differently by different users. Another limitation of this model; it does not clarify how to make technology easy to use or useful and thus, aiding no design advice.

TAM has often been altered to fit into a certain context depending on the technology and scenario (Rauniar et al., 2014). Every model has its limitations and TAM is no different; thus, there are other revised alternatives, such as TAM2, extended TAM, Unified Theory of Acceptance and Use of Technology (UTAUT), etc. Since this study, too, aims to develop the model, we adhere to the initial version within its field of information technology. Additionally, we chose one of the revised versions of TAM that we saw fit according to the scope of this study, which focuses heavily on the consumers as do VAM.

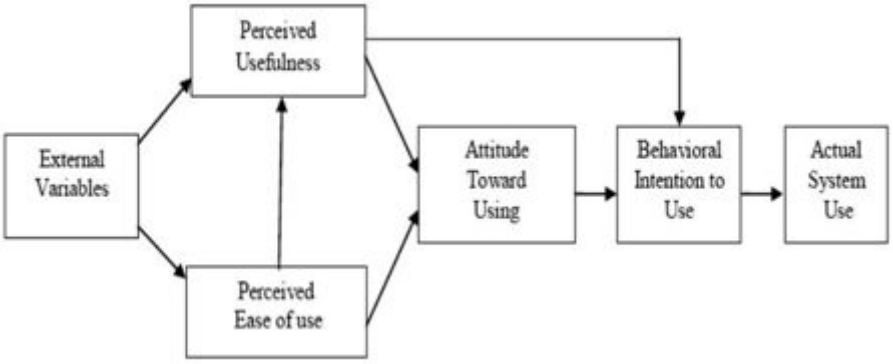


Figure 3. Technology Acceptance Model (TAM), (Davis, 1989, 1993).

2.4.3 Value-based Adoption Model (VAM)

The Value-based Adoption Model (VAM) was developed in a study by Kim, Chan & Gupta (2007) and is a revised version of TAM. The model takes inspiration from theories such as the theory of consumer choice and decision making within the economy and marketing field.

Unlike TAM, VAM recognizes that a technology user can be more outside of an organizational setting, namely a consumer (Kim, Park, & Choi, 2017). Whereas technology adoption and usage might be mandatory within an organization, a consumer often has other options. Whether the consumer chooses to engage in the adoption process of a product is often voluntary due to other available alternatives to choose from.

According to the model, the consumer's *perceived value* will be affected by two categories of factors; the *perceived sacrifice* and the *perceived benefit* (Lin, Wu, Hsu & Chou, 2012). The trade-off then determines if the user has the *intention to adopt* and use the technology in question - or not. In this way, VAM establishes itself on the basis of each consumer having a value maximization mindset in relation to technology adoption (Kim et al., 2007).

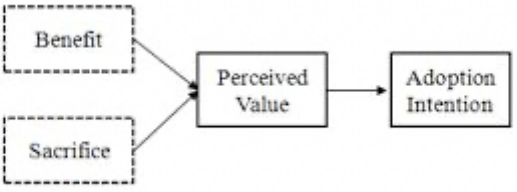


Figure 4. Value based adoption model of technology (Kim et al., 2007).

Smart Cart is an interactive innovation and its implementation will require a digital transformation as well as consideration for privacy risks. Using TAM and VAM as a foundation, we seek to explore the aspects of this technology's adoption.

3. Conceptual Model and Hypotheses Development

This study develops a research model as shown in figure 5, which is based on an integration of the Technology Acceptance and Value-based Adoption Model. Our research model proposes a framework to examine the influence of beneficial and sacrificial factors on the perceived value. The perceived value will in turn be analysed in terms of how it can potentially lead to the adoption and use of the Smart Cart.

The section beneath further elaborates on the network of casual relationships and links between each construct as depicted in figure 5. Finally, the theoretical rationale provides a foundation for the five hypotheses of our study.

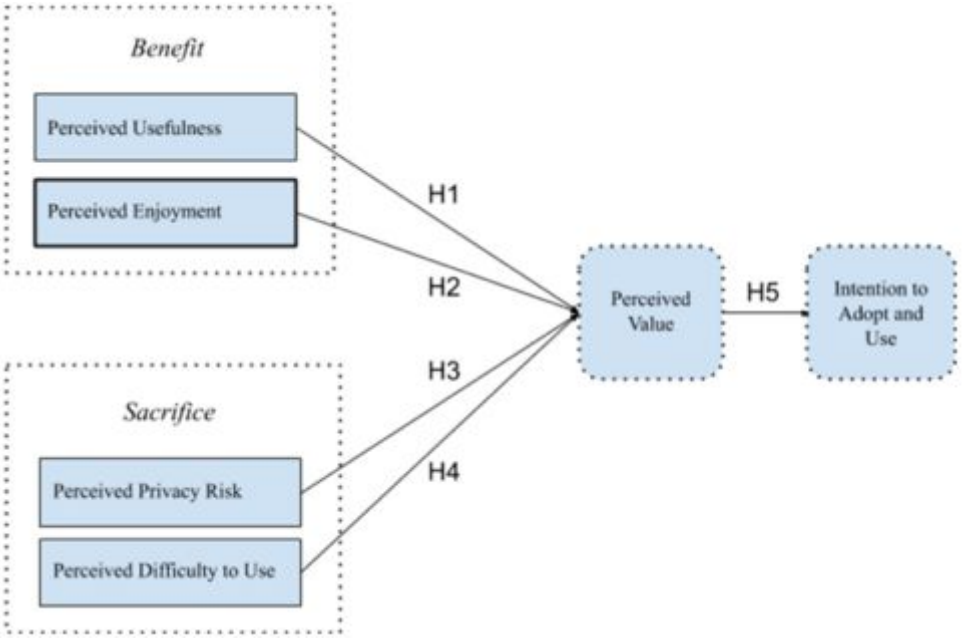


Figure 5. Research model.

3.1 Perceived Benefit

3.1.1 Perceived Usefulness

Davis (1989) defines perceived usefulness as "the degree to which a person believes that using a particular system would enhance his or her job performance" (p. 320). When developing TAM, he came to the conclusion that it is one of the determining factors and has a significant impact on the intention to use IT. Gao and Bao (2014) add that technologies can further improve retail stores in a number of areas, such as their processes, queuing times and the likes, which consumers perceive to improve service quality. In their study, they predicted the likelihood of perceived usefulness to be high when it comes to technologies within service convenience as they have shown to increase consumer satisfaction.
Similarly, we expect the following:

H1. *Perceived Usefulness (PU)* can have a positive influence on the *Perceived Value (PV).*

3.1.2 Perceived Enjoyment

In 1992, Davis, Bagozzi and Warshaw published a study adding perceived enjoyment as an impacting factor on intention to use. By utilizing computers in a workplace, they were able to define perceived enjoyment as "the extent to which the activity of using the computer is perceived to be enjoyable in its own right, apart from any performance consequences that may be anticipated". Several other studies have had similar results, being able to distinguish emotional value as an intrinsic motivation, driving the user to adopt and further use a new technology (Bruner & Kumar, 2005; Venkatesh, 2000). Accordingly, we propose a hypothesis:

H2. *Perceived Enjoyment (PE)* can have a positive influence on the *Perceived Value (PV).*

3.2 Perceived Sacrifice

3.2.1 Perceived Privacy Risk

As digitalisation rapidly increases, so does the concern regarding the protection of users' data and preservation of their data privacy (Wuenderlich et al., 2015). The intent and use of information create an issue of trust as well as a need for risk assessment depending on how experienced the shopper is (Liao et al., 2011). Previous studies has shown perceived concerns regarding the wide aspect of privacy can have a negatives influence on attitudes when adopting or using technology (Müller-Seitz, Dautzenberg, Creusen, & Stromereder, 2009), not to mention the intention of further use (Hsu & Lin, 2016). Thus, we hypothesize:

H3. *Perceived Privacy Risk (PPR)* can have a negative influence on the *Perceived Value (PV).*

3.2.2 Perceived Difficulty to Use (based on Perceived Ease of Use)

According to TAM, perceived ease of use has a significantly positive effect on perceived usefulness. The perception goes, the determinant of behavioural intentions and likelihood of technology adoption depends on how easy a shopper perceives the technology (Davis, 1989; Lee, Park, Chung, & Blakeney, 2012). The degree to which an innovation is easy to use can also derive difficulties at the other end of the spectrum. If the consumer perceives the use of technology as difficult, it becomes a sacrifice and we therefore hypothesise the following:

H4. *Perceived Difficulty to Use (PDU)* can have a negative influence on the *Perceived Value (PV).*

3.3 Perceived Value, Intention to Adopt and Use

3.3.1 Perceived Value

Many definitions of value exist, but within this field of study researchers deem Zeithaml's definition as the most widely accepted (Hsu & Lin, 2018; Kim et al., 2007). According to Zeithaml (1988) perceived value is "the consumer's overall assessment of the utility of a product based on perceptions of what is received and what is given" (p. 14). Though, he does

also recognize that what is perceived as a benefit or sacrifice varies depending on the consumer. Thus, if the consumer perceives the 'get' components to exceed the 'give' components, the technology will be perceived as valuable and further enhance the adoption likelihood (Featherman et al., 2010; Inman & Nikolova, 2017).

3.3.2 Perceived Intention to Adopt and Use

According to VAM, perceived value has a significantly positive effect on adoption intention. Kim et al. (2007) confirm that sacrifice components and benefit components have a strong positive correlation to the intention to adopt, but even the intention to use. Similarly, Yang, Yu, Zo & Choi (2016) suggest value perception as an indicator to predict and understand customer adoption behaviour as well as continuance intention. In this study, we focus on the likelihood of technology adoption and to what extent the consumer would potentially use Smart Cart in the future.

Considering the theoretical rationale of the two constructs above, we propose the following hypothesis:

H5. *Perceived Value (PV)* can have a positive influence on the *Intention to Adopt and Use (IAU)*.

4 Method

With keeping the research question and goal in mind, the chosen methods and the motivation for choosing those methods to conduct this study, are presented in the following chapter:

4.1 Research Strategy

As Denscombe (2014) mentions in the book "Forskningshandboken: För småskaliga forskningsprojekt inom samhällsvetenskaperna", the choice of the research strategy plays a vital role in successful conduction and completion of a research project. Based on this, different methods such as *Soft System Methodology* (SSM), semi formal interviews etc, were discussed thoroughly before we narrowed it down to using a survey as our research strategy. We chose this method because it is one the most appropriate and effective ways to get other people's opinions, preferences and contributions (Denscombe, 2014). Moreover, given the time and resource constraints, a questionnaire was a better option to use for this scope since Denscombe (2014) refers to quantitative research as to being an opportunity to generalize research findings to a larger context whereas a qualitative study would likely require a more detailed approach.

We wanted to gain insight into peoples' attitudes and behaviors towards new technology to understand what the potential factors were in technology adoption, which could affect the eventual intention to use. Our study is focused on exploring the influence of different factors on intention to use and a survey approach is being used as the research strategy. Thus, a quantitative approach was chosen where, with the help of descriptive statistics, we plan on identifying and exploring frequencies, correlations and patterns.

4.2 Data Collection

Our study required a theoretical framework to support and analyse our survey results. Similarly, a theoretical rationale was required as foundation for an effective survey formulation, which is why we decided on conducting a literature study to aid in both objectives.

The intention with the literature study was to identify the relevant adoption factors to include in the study and this was achieved by conducting a well planned and systematic literature research. With identified adoption factors as foundation, we formulated and distributed our survey to gather users' input and response to the eventual use of Smart Cart in the future.

4.3 Conduction of Literature Study

As mentioned in the introduction earlier, companies do not have access to vast amounts of funding anymore to invest in new technologies. So when a new technology is developed and launched into the market, what are the chances that based on its features, it will be received well by the customers? In an era where we get to see and experience many new technologies, what factors make one technology stick and not the others? This was the area that we wanted to explore in our study but with a focus on Smart Cart. It is a relatively new technology which is currently being produced and distributed by a Finnish technology company. As it

has not been introduced in Denmark, Sweden and Norway yet, we considered that as an advantage as it presented us with the opportunity to gather respondents' non-compromised input and feedback about the product since they have not had a chance to use and form an opinion of it yet.

Regarding the literature study, we used the book Rapporter and Uppsatser (Backman, 2013) as an underlay for different parts. The Systematic literature search was started by using the following keywords; *Technology Adoption Model, technology adoption, Factors affecting the adoption of new technology, Value-Based Adoption Model AND Digital Transformation.* We conducted the search in the following databases: *Google Scholar, IEEE Explore, Diva, ACM Digital Library* och *Malmö Universitets bibliotek.* We also decided on certain inclusion- and exclusion criteria which included the following; only articles or studies which are published between 2000 and 2019 will be utilized. This criteria held a couple of exceptions where some of our sources date back to the 1980s because it was recommended to use the original theory sources instead of the later articles. Moreover, the language for the used material was restricted to only English and Swedish. Furthermore, it was agreed upon that an effort was to be made to only use peer-graded and cited articles and studies as a way to ensure their credibility and reliability. In the beginning of the search process, the focus was solely put on reading the title and the abstract of the studies that seemed relevant in order to utilize the available time in the best possible way. Only after the study had been deemed useful to our goal, were whole articles or studies read.

The literature search enabled us to obtain a better understanding of the factors that can have an influence on intention to use a new technology, in this case The Smart Cart, which aided in the development of the study's Conceptual model and its hypothesis.

4.4 Conduction of Survey

An internet approach was used to collect the empirical data for this study. The survey was formed in Google Forms and the format was kept professional and neutral. Since the Smart Cart technology is new and has not been launched in Denmark, Sweden and Norway yet, a text and a video with information about the Smart Cart was added in the beginning of the form to give the respondents necessary foundation and information about the technology. No text about the intention with the survey was added in the form, instead an introductory text was written on every platform that was used before the respondents opened the survey. This was done because we wanted to attract people to respond to the survey by reading the introductory text which entailed that we were two Malmö University students and would really appreciate their help with our graduate thesis. Since we had decided on not offering any monetary rewards to the respondents because Denscombe (2014) refers to that any economical or material rewards can have big influence on such surveys, we decided on personally approaching and appealing to respondents to take the time and fill our form. It had worked well since we were able to collect 156 responses overall.

Instead of having one long Questionnaire which could have proven overwhelming to some respondents, the survey was divided in eight different part; *Introduction* with informational text and video, *Control questions* to get an understanding of the respondents and their habits, Perceived Usefulness, Perceived Enjoyment, Perceived Privacy Risk, Perceived Difficulty to Use, Perceived Value and Intention to Adopt and Use. The questions consisted of two types; *multiple choice* questions with predetermined answers and statements where responses were given on a *five point Likert scale*, with 1 referring to *strongly disagree* and 5 referring to *strongly agree* (Chang, Dong & Sun, 2014). The multiple choice questions were later coded so that they could easily be studied in the analysis.

We tried hard to keep the language of the questions easy to understand in order to avoid any misunderstanding and misinterpretation. Moreover, we decided on using English as the language for the survey instead of creating it individually in Dannish, Swedish and Norwegian to be published in their respective countries. This choice was made because we were concerned that there was a possibility that some information or parts might get lost in the translation given our limited knowledge of the above mentioned languages.

After the formation of the survey, it was tested on a control group of five people. The obtained feedback included that the text with the information about the Smart Cart did not convey the purpose and features of the product effectively, instead one must watch the video first in order to understand it properly. Another responder reported that some of the questions were too long and had to be read multiple times before they could respond.

As a result of the obtained feedback, we made changes in the text to make it more comprehensive and a text was included before the video where the respondents were urged to watch the video, which was less than two minutes long before starting the survey in order to gain better understanding of the technology. The video was acquired from the website of the Finnish company Smartcart (Smartcart, 2019) and an email was sent requesting permission to use their video in this context. The longer questions were made shorter so that they had not to be read multiple times any longer.

4.4.1 Selection Group for the Survey

The survey was published on Facebook and it was individually sent to people also via text and mail. Since we shared the survey on social media forums, it is hard to obtain an exact number of people who saw our post, thus a response rate is incalculable. All those who visit their supermarkets for grocery shopping were considered a part of the target group for our study. Most forums or groups on social media prohibit the publishing of such surveys so it limited the possibility of us getting input and insight from a wider range of respondents based on demography and geography which is eventually shown in our results too. Nonetheless, It was our hope that the obtained answers from the survey would shed light on how people think and perceive the new technology.

4.5 Design of the Questionnaire

The inspiration for the questions was widely taken from multiple previously published studies, but the questions were later rephrased to reflect the context of our study. Table 1 shows the questions and their references that were included in the survey.

Table 1. Questionnaire.

Variables	ID	Description	Answer Type	Reference
The Smart Cart is introduced to the respondents through a description and an informative video.				
Control Questions	CQ1	Gender: What gender do you identify with?	Multiple Choice	Dong, Chang, Wang, & Yan, 2017
	CQ2	Age: How old are you?	Multiple Choice	Dong et al., 2017
	CQ3	Country: What country do you reside in?	Multiple Choice	Arango, Huynh, Fung & Stuber, 2012
	CQ4	How often do you visit the supermarket/week?	Multiple Choice	Dong et al., 2017
	CQ5	How do you check out your groceries most often?	Multiple Choice	Dong et al., 2017
	CQ6	How do you pay for your groceries most often?	Multiple Choice	Hsu & Lin, 2018
Perceived Usefulness	PU1	Using the Smart Cart would enable me to finish grocery shopping more quickly.	Likert	Gao & Bai, 2014; Hsu & Lin, 2018
	PU2	Using the Smart Cart functions such as access to over 6000 recipes, access to product information and help in product location and navigation through the store would significantly increase the quality or output of my shopping experience.	Likert	Gao & Bai, 2014; Yang, Yu, Zo & Choi, 2016
	PU3	Smart Cart would provide a very useful service and information about my groceries to me.	Likert	Yang, Yu, Zo & Choi, 2016; Hsu & Lin, 2018
	PU4	Overall, I believe that using the Smart Cart would be useful in my life.	Likert	Dong et al., 2017; Yang, Yu, Zo & Choi, 2016
Perceived Enjoyment	PE1	The process of using the Smart Cart service would be enjoyable.	Likert	Yang, Yu, Zo & Choi, 2016; Hsu & Lin, 2018; Gao & Bai, 2014
	PE2	The use of Smart Cart would be a pleasurable experience.	Likert	Yang, Yu, Zo & Choi, 2016; Hsu & Lin, 2018; Gao & Bai, 2014
	PE3	I would have fun using the Smart Cart service.	Likert	Yang, Yu, Zo & Choi, 2016; Hsu & Lin, 2018; Gao & Bai, 2014
Perceived Privacy Risk	PPR1	I am concerned that the Smart Cart will collect too much data about me.	Likert	Mani & Chouk, 2017
	PPR2	I am concerned that the collected data might be used in an uncertain way.	Likert	Mani & Chouk, 2017

	PPR3	I am worried that the use of Smart Cart will lead to a loss of privacy.	Likert	Hsu & Lin, 2018
Perceived Difficulty to Use	PDU1	It is of vital importance to me that the Smart Cart is easy to use.	Likert	Kim et al., 2007
	PDU2	I am not always willing to make an effort to learn a new technology.	Likert	Kim et al., 2007
	PDU3	System efficiency (its ability to connect and load without an error) is important to me while trying out the Smart Cart.	Likert	Kim et al., 2007
	PDU4	I am not likely to spend a lot of time in order to learn a new technology.	Likert	Kim et al., 2007
Perceived Value	PV1	Compared to the effort and time I need to put in to learn the ways of new technology, in this case, the Smart Cart, I consider the use of this technology beneficial to me.	Likert	Hsu & Lin, 2018
	PV2	Smart Cart will make the shopping experience easier for me.	Likert	Kim et al., 2007
	PV3	I intend to recommend my friends to use Smart Cart in the future.	Likert	Kim et al., 2007
Intention to Adopt and Use	IAU1	I intend to give Smart Cart a chance in the future.	Likert	Kim et al., 2007
	IAU2	I predict that I will use Smart Cart in the future.	Likert	Kim et al., 2007
	IAU3	I will frequently use Smart Cart in the future.	Likert	Dong et al., 2017; Gao & Bai, 2014

4.6 Problems in Execution

A number of issues were identified after the survey was sent and we started receiving answers with feedback. Although feedback was not a requirement for the respondents, except they only needed to fill in the questionnaire. Nonetheless, some respondents provided us with the following feedback:

4.6.1 Video Placement

A few respondents complained that because the video was only included on the first page, they had to go back and forth if they wanted to review anything while answering the survey. This issue should be taken into consideration while designing a survey in the future. It is important to responders to include some kind of information or illustrating video on every page of the survey.

4.6.2 Missing Options

A couple of respondents raised the issue that did not have the possibility to expand on their answers, for example, if there is something they do not completely agree to, then they wanted to have a possibility to elaborate on their choice. Although we had designed our survey in

order to get straightforward answers so that they can later be analysed and the option to expand on the answers did not fit our context and study design, this option should definitely be taken into consideration while designing any surveys in the future.

4.6.3 Coercive Language

The feedback provided by some respondents referred to the language used in the survey as being Coercive in some instances. For example, one respondent commented that in the case of one of the questions in the last part of the survey "*I intend to give Smart Cart a chance in the future"* , it felt like the authors of the survey were fishing for a positive answer and manipulating their respondents in that direction. Although we used solid sources for all our questions, including the one in question, and tried our best to be neutral, this point will definitely be taken into consideration in any future surveys.

4.6.4 Risks

Even though we deliberately and actively tried to use as easy and common language as possible in our questions, we are aware of the risk that some respondents might have had a comparatively difficult time understanding the meaning of the questions which could affect their answers. Consequently, this could affect and influence our study's reliability and validity because in order to complete and submit the survey, all the questions were mandatory and had to be answered. The respondents were not given the opportunity to skip any questions based on any reason even if it was difficult to understand.

Overall, we were also able to obtain some positive feedback where respondents liked and appreciated the design and theme of the survey.

4.7 Analysis Method

4.7.1 Descriptive Statistics

Statistical analysis has been used for the analysis of the gathered data. The process started with coding and entering the data into SPSS to be analyzed later. Table 2 shows the descriptive statistics of the respondents and figure 6 shows the descriptive statistics of the variables used in the survey.

Table 2. Descriptive Statistics of the respondents.

Variables	Items	Frequency	Percentage
Gender	Female	74	47.4
	Male	81	51.9
	Prefer not to say	1	0.6
Age	Under 18	3	1.9
	18-30	39	25.0
	31-45	86	55.1

	46-65	28	17.9
Country	Denmark	76	48.7
	Norway	4	2.6
	Sweden	76	48.7
SMVisit (Supermarket visits)	Less than once a week	9	5.8
	Once a week	39	25.0
	Two-Three times a week	80	51.3
	More than 4 times a week	28	17.9
SMCheckout	Cashier checkout	86	55.1
	Self checkout	35	22.4
	Self scanner	35	22.4
Payment	Cash	8	5.1
	Card	138	88.5
	Mobile payment	9	5.8
	Membership cards	1	0.6
Total		156	100.0

The *Mean* values in figure 6 shows the most common or submitted answer for every variable. For example, for PU1 the mean value is 3.81, which means that most answers were between 3 and 4 with more respondents answering 4 than 3. The column Std. Deviation shows the items where the respondents were most variable on. For example, PPR3 has a standard deviation value of 1.346 which means that this item received more variety of answers than any other variable and the answers are more evenly distributed across the scale.

	Mean	Std. Deviation	N
PU1	3.81	.991	156
PU2	3.72	1.069	156
PU3	3.85	.969	156
PU4	3.73	1.056	156
PE1	3.81	.938	156
PE2	3.78	.959	156
PE3	3.67	1.085	156
PPR1	3.12	1.277	156
PPR2	3.10	1.289	156
PPR3	3.03	1.346	156
PDU1	4.35	.870	156
PDU2	3.10	1.321	156
PDU3	4.16	.967	156
PDU4	3.26	1.228	156
PV1	3.53	1.006	156
PV2	3.71	1.061	156
PV3	3.50	1.122	156
IAU1	3.96	1.015	156
IAU2	3.71	1.055	156
IAU3	3.50	1.075	156

Figure 6. Descriptive statistics of the variables.

4.7.2 Reliability Statistics

As high quality tests are important to assess reliability of the supplied data (Tavakol & Dennick, 2011), Cronbach's alpha has been used to assess the reliability of this survey. It is a measure which is used to obtain internal consistency of a test and is expressed as a number between 0 and 1 with a recommended range between 0.70 to 0.95 (ibid). If the value is any lower than 0.70 then it might be a good idea to revise or discard some questions. On the other hand, if the alpha is too high then that might mean that some of the items are redundant so a maximum of alpha value of 0.90 has been recommended (ibid).

Reliability statistics of the variables are shown in figure 7. We used Cronbach's alpha to assess the reliability of the questionnaire. SPSS was used to generate the value of alpha which was $\alpha = 0.885$. As it lies above 0.70, the questionnaire can be considered to have reached good reliability and that it measures what it was intended to measure. Some of the variables in the figure 7 result in a higher alpha if they are deleted, but the difference is minimal. In such cases, it is recommended to take the full context into consideration and to retain the items if they are considered essential to the study.

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
PU1	68.59	132.527	.712	.873
PU2	68.67	130.892	.724	.872
PU3	68.54	133.579	.680	.874
PU4	68.67	130.108	.769	.871
PE1	68.59	132.192	.774	.872
PE2	68.62	132.109	.758	.872
PE3	68.72	131.143	.702	.873
PPR1	69.28	146.549	.051	.895
PPR2	69.30	146.354	.056	.895
PPR3	69.37	147.924	.000	.898
PDU1	68.05	139.275	.473	.880
PDU2	69.29	143.035	.157	.892
PDU3	68.24	138.285	.463	.880
PDU4	69.14	143.167	.173	.890
PV1	68.87	132.879	.684	.874
PV2	68.69	131.285	.713	.872
PV3	68.90	129.977	.724	.872
IAU1	68.44	133.873	.632	.875
IAU2	68.69	131.918	.690	.873
IAU3	68.90	132.338	.658	.874

Figure 7. Reliability statistics for the items/variables included in the questionnaire.

4.7.3 Correlational Analysis

A correlational analysis has been done in SPSS to determine if the collected data fulfills its purpose and provide support to the studies' hypotheses. Correlation Analysis is used to explore the connection between variables and factors (Choi, Peters & Mueller, 2010). Different methods for running this analysis were considered. The Pearson product-moment correlation coefficient 'r' is the most commonly used method when it comes to analysing and describing the correlation between two continuous variables (ibid). We used a five point Likert scale with five values- strongly disagree, disagree, neutral, agree and strongly agree- where even when the measurement scale is classified as Ordinal, the variable is considered to be continuous and therefore, fit for Pearson correlation analysis (Laerd.com, n.d.).

The most commonly used formula to calculate Pearson's r is $r = \sum[(x_i - x/s_X)(y_i - y/s_Y)]/n.$ The values generated from Pearson's r each fall between -1 and +1 where the sign of r (either + or -) represents the direction of the association while the number represents the strength of the correlation. This means that the closer the correlation is to 1, the stronger the correlation is and the more interdependent the variables are. Negative values represent negative association and positive values represent positive association (ibid). The next stage consisted of running Pearson's correlation analysis in SPSS to explore the correlations of the variables and it is presented in the next chapter.

Table 3. Interpretation model for Pearson's r (Laerd.com, n.d.).

Strength of Association	Coefficient, *r*	
	Positive	Negative
Small	.1 to .3	-0.1 to -0.3
Medium	.3 to .5	-0.3 to -0.5
Large	.5 to 1.0	-0.5 to -1.0

5 Results

5.1 Survey Results

A total of 156 responses were collected through social media, email and texts (*for more information, see 4.4 Survey*). A summary of the responses is presented in the following chapter. Detailed results can be found in *Appendix A* with all the questions and statements with their respective IDs can be found in *Table 1*.

5.1.1 Respondents' Shopping Routine

The questionnaire started with six control questions where respondents were asked to provide some basic information about themselves and their shopping habits. From the 156 responses that were received, 74 (47.4%) were women while the majority of the responses were from males which were 81 (51.9%). We also received one response where the respondent was unwilling to disclose their gender *(Prefer not to say)*.

The majority of the responses were received from the age group *31-45* which stood for more than half of the total responses (55.1%) and the second dominant age group was *18-30* where the received responses stood for 25% of the total. Only 3 (1.9%) responses were received for the group *Under 18* and that could be because our survey was unable to reach a wider range in that age group. When it came to the Country (CQ3), the responses were equally divided between Denmark and Sweden where each stood for 48.7% of the responses. Only 4 (2.6%) responses were received from Norway.

The respondents were asked to give information about their supermarket visits (CQ4) where the majority of the respondents fell into the option *Two-Three times a week* (51.3). The second dominant group was *Once a week* which comprised 25% of the total responses. Only 9 (5.8%) people responded that they visit the supermarket *less than once a week* and 28 (17.9%) people responded that they visit the supermarket *more than 4 times a week*.

When it came to Supermarket checkout methods (CQ5), *Cashier checkout* at 86 (55.1%) stood for more than half of the total responses while the rest was evenly divided between *Self checkout* (22.4%) and *Self Scanner* (22.4%). Payment methods (CQ6) saw a clear majority of *Card* as a payment method which comprised 88.5% of the total responses while *Cash* and *Mobile payments* stood for 5.1% and 5.8% respectively. Only 1 (0.6%) respondent said that they used *Membership cards* as a payment method.

5.1.2 Respondents' Experience of Smart Cart's Usefulness

A clear majority of the respondents which stood for 63.5% of the total answered that by using Smart Cart, they will be able to finish grocery shopping more quickly (PU1). Moreover, 58.3% of the respondents agreed that using the Smart Cart's functions such as product location and navigation (PU2), would significantly increase the quality of their shopping experience. A majority of the respondents (59%) agreed that Smart Cart would provide them useful service and information about their groceries (PU3). When responding to PU4, a majority of the respondents (58.3%) believed that using the Smart Cart would be useful.

5.1.3 Respondents' Perceived Enjoyment of Smart Cart

A majority which comprised 59% of the responses said that using the Smart Cart would be enjoyable (PE1) and provide a pleasurable experience (PE2). A majority of respondents (51.3%) believed that they would have fun while using the Smart Cart for grocery shopping.

5.1.4 Respondents' Perceived Privacy Risk of Smart Cart

37.8% of the respondents agreed that the Smart Cart would collect too much data about them (PPR1) while 29.5% of the respondents did not believe that to be the case. 37.8% of the respondents agreed that they are concerned that the collected data about them might be used in an unintended way (PPR2) while 30.1% of the respondents did not believe that that would happen. When it came to the loss of privacy by using the Smart Cart (PPR3), 37.2% of the respondents agreed to that while 35.2% believed that using the Smart Cart would not cause them any privacy loss.

5.1.5 Respondents' Approach on Perceived Difficulty to Use

A clear majority with 79.5% of the respondents agreed that it is important for them that the Smart Cart should be easy to use (PDU1). When the respondents were asked about their willingness to make an effort to learn a new technology (PDU2), 40.3% responded that they were not willing to make the effort while 32% of the respondents answered that they were willing to do that. A clear majority of the respondents (71.8%) answered that system efficiency while using the Smart Cart is important to them (PDU3). 40.4% of the respondents answered that they were not likely to spend a lot of time learning a new technology while 27.5% responded that they were likely to do so (PDU4).

5.1.6 Perceived Value of the Smart Cart and Intention to Adopt

46.8% of the respondents agreed that compared to the time and effort that they will likely have to invest learning the ways of the Smart Cart, the use of the technology will be beneficial to them (PV1) while 40.4% respondents remained neutral to the statement. A majority of the respondents (59%) agreed that the use of the Smart Cart will make the shopping experience easy for them (PV2). 48.7% of the respondents believed that they would recommend Smart Cart to their friends while 32.7% of the respondents remained neutral to the statement (PV3).

A vast majority of the respondents (72.4%) answered that they intended to give the Smart Cart a chance in the future (IAU1) while 60.9% predicted that they will use Smart Cart in the future (IAU2). When it came to the frequency of the use of Smart Cart (IAU3), 45.5% of the respondents answered that they will frequently use it while 41% remained neutral to the statement.

5.1.7 Response Distribution of the Used Variables

The figure below presents an overview of the spread of responses to all the response alternatives. Mode values are presented in bold and colour to highlight the highest number of responses in each question and statement.

Totally disagree		1	2	3	4	5 Totally agree
Variables	ID	Spread of responses				
Perceived Usefulness	PU1	3	11	43	**55**	44
	PU2	5	13	**47**	46	45
	PU3	2	6	**56**	41	51
	PU4	4	14	**47**	46	45
Perceived Enjoyment	PE1	2	6	**56**	48	44
	PE2	1	12	**50**	**50**	43
	PE3	3	17	**56**	32	48
Perceived Privacy Risk	PPR1	22	24	**51**	31	28
	PPR2	24	23	**50**	32	27
	PPR3	27	28	**43**	29	29
Perceived Difficulty to use	PDU1	1	2	29	34	**90**
	PDU2	25	25	**43**	35	28
	PDU3	1	6	38	33	**78**
	PDU4	13	30	**50**	30	33
Perceived Value	PV1	3	17	**63**	40	33
	PV2	5	14	45	**50**	42
	PV3	6	23	**51**	39	37
Intention to adopt and Use	IAU1	2	15	26	**57**	56
	IAU2	5	15	41	**55**	40
	IAU3	7	14	**64**	36	35

Figure 8. The survey's answer distribution with modal value in bold and highlighted.

5.2 Correlations between Variables

Identified correlations between variables are presented in the following section. Figure 9 shows all the correlations, including strong, medium and weak. Any correlation that is higher than 0.3 or lower than -0.3 is considered either strong or medium. Value '1', which shows perfect correlation, is showing the correlation between the same item. The strong and medium strong correlations are highlighted in green and blue respectively in order to facilitate the detection of the strong ones from the weak ones.

	PU1	PU2	PU3	PU4	PE1	PE2	PE3	PPR1	PPR2	PPR3	PDU1	PDU2	PDU3	PDU4	PV1	PV2	PV3	IAU1	IAU2	IAU3
PU1	1.000																			
PU2	.711	1.000																		
PU3	.716	.708	1.000																	
PU4	.777	.757	.768	1.000																
PE1	.661	.661	.629	.691	1.000															
PE2	.689	.639	.652	.700	.879	1.000														
PE3	.667	.628	.641	.678	.788	.793	1.000													
PPR1	-.114	-.065	-.210	-.100	-.067	-.084	-.129	1.000												
PPR2	-.137	-.107	-.200	-.118	-.081	-.119	-.167	.859	1.000											
PPR3	-.150	-.133	-.224	-.171	-.102	-.149	-.200	.846	.835	1.000										
PDU1	.302	.360	.382	.418	.367	.362	.257	-.102	.005	-.043	1.000									
PDU2	-.014	.125	.072	.057	.047	.023	.055	.084	.115	.078	.115	1.000								
PDU3	.295	.405	.397	.396	.426	.413	.315	-.152	-.054	-.133	.616	.174	1.000							
PDU4	.014	.113	.043	.049	.110	.053	.049	.058	.054	.061	.128	.608	.177	1.000						
PV1	.550	.551	.557	.616	.602	.622	.563	-.056	-.094	-.113	.452	.201	.429	.145	1.000					
PV2	.731	.656	.710	.730	.630	.628	.622	-.202	-.173	-.224	.426	.008	.392	.029	.595	1.000				
PV3	.673	.632	.620	.703	.693	.690	.692	-.119	-.172	-.156	.298	-.009	.306	.005	.609	.743	1.000			
IAU1	.518	.489	.506	.550	.562	.581	.528	-.151	-.096	-.193	.468	-.011	.420	.075	.488	.558	.612	1.000		
IAU2	.631	.540	.519	.624	.608	.612	.581	-.131	-.098	-.152	.379	-.029	.357	.039	.514	.648	.703	.748	1.000	
IAU3	.576	.508	.523	.586	.589	.601	.656	-.101	-.100	-.127	.262	-.027	.227	.020	.492	.673	.723	.627	.780	1.000

Figure 9. Identified correlation per variable.

Correlation analysis in figure 9 shows a clear relationship between perceived usefulness (PU) and perceived enjoyment (PE). Respondents who believe that Smart Cart will be useful for them tend to reply positively to Smart Cart's ability to offer a fun-filled and enjoyable experience. Moreover, it can be observed from the figure that respondents have appeared to have replied consistently in these two areas and the responses correlate internally between these two factors. The greatest relationship was identified in PU4 (" Overall, I believe that using Smart Cart will be useful in my life") and PE2 ("The use of Smart Cart would be a pleasurable experience") with a correlation value of 0.70.

It can be observed from figure 9 that when the perceived privacy risk (PPR) was concerned, respondents tended to answer consistently and the responses correlated internally. A strong internal correlation was identified between PPR1 ("I am concerned that the Smart Cart will collect too much data about me.") and PPR2 ("I am concerned that the collected data might be used in an uncertain way.") which stood at 0.86. As for the perceived difficulty to use, the responses varied from weakly correlated to strongly correlated. The strongest internal correlation that could be identified was between PDU1 ("It is of vital importance to me that the Smart Cart is easy to use") and PDU3 ("System efficiency (its ability to connect and load without an error) is important to me while trying out the Smart Cart") which stood at 0.62. No strong correlations between the two Sacrifices could be identified.

No strong correlations could be identified between Benefits (PU and PE) and Sacrifices (PPR and PDU). Though it could be observed that people who perceive the product as useful (PU) and enjoyable (PE) tend to focus less on the privacy risk (PPR) and are not as concerned about if it is easy to use or not (PDU). A medium-strong correlation could be identified between PU4 and PDU1 indicating that people who believe that Smart Cart will be useful in their life, also want the technology to be easy to use. Another medium correlation was found between PDU3 and PE1 & PE2 which indicates that respondents believe that system efficiency is important in order to make the experience of using Smart Cart enjoyable and pleasurable.

It is apparent from figure 9 that all the variables from PU and PE have a strong connection with perceived value (PV). The strongest influence on respondents' perception of value was found in the variables PU1 ("Using the Smart Cart would enable me to finish grocery shopping more quickly"), PU3 ("Smart Cart would provide a very useful service and information about my groceries to me.") and PU4 ("Overall, I believe that using the Smart Cart would be useful in my life.") which lies between the ranges 0.550-0.731, 0.557-0.710 and 0.616-0.730 respectively. Moreover, PE1 ("The process of using the Smart Cart will be enjoyable") which lies between 0.602 and 0.693, also shows a strong correlation with perceived value (PV) and the same applies to the rest of the variables in Benefits. Thus, the result supports the H1 and H2.

No strong dependence was found between respondents' concern for privacy risk (PPR) and their perception of value (PV). The identified correlations were weak and ranging from -0.56 to 0.202, -0.094 to -0.173 and -0.113 to 0.224, which indicated having almost no or minimal influence on perceived value (PV). The correlations between variables in PDU and PV vary in intensity. A medium-strong connection was observed between PV and two items from perceived difficulty to use, i.e. PDU1 ("It is of vital importance to me that the Smart Cart is

easy to use.") & PDU3 ("System efficiency, its ability to connect and load without an error, is important to me while trying out the Smart Cart."). The observed connection between PV and PDU3 measures up till 0.452 and for PV and PDU3, the correlation measures up till 0.420. These results lead to believing that respondents' perception of value is partially or to some extent dependent on technology's ease of adoption and use which partially support H4 whereas only minimal support could be found for H3.

Strong correlations were found between factors 'intention to adopt and use (IAU)' and 'perceived value (PV)'. All the included variables show strong connections which start from 0.488 and measure up till 0.723 and can be interpreted as a strong support for H5.

5.3 Statistical Conclusion of the Hypotheses

In the previous chapter, all the possible correlations and connections are presented that were gathered with the help and support of the collected empirical data. Based on this, we answer the study's hypotheses:

H1. *Perceived Usefulness (PU)* can have a positive influence on the *Perceived Value (PV).*
H2. *Perceived Enjoyment (PE)* can have a positive influence on the *Perceived Value (PV).*
H3. *Perceived Privacy Risk (PPR)* can have a negative influence on the *Perceived Value (PV).*
H4. *Perceived Difficulty to Use (PDU)* can have a negative influence on the *Perceived Value (PV).*
H5. *Perceived Value* can have a positive influence on the *Intention to Adopt and Use (IAU).*

We managed to find strong support for H1, H2 and H5, medium support for H4 and weak support for H3. The results are summarised in the following table:

Table 4. Compilation of Hypotheses.

H1	Strong support
H2	Strong support
H3	Weak support
H4	Medium-strong support
H5	Strong support

6 Discussion

After conducting a literature review and a survey, this chapter aims to break down the results. The results will be further investigated, confirming which hypotheses are validated and insight will be provided to explain why some of our hypotheses might have received less support.

6.1 Factors Contributing to the Adoption and Use of Smart Cart

According to figure 8, the data value that appears most often in the survey answers of this study is three on the five point Likert scale. Although, three is the modal value in 13 out of 20 questions, it should not be interpreted as the survey participants being indecisive. figure 6 shows that the mean value is 3.50 and above in the perceived benefits, the perceived value as well as the intention to adopt and use, meaning that a majority of our survey participants chose answers above three on the Likert scale. Considering the standard deviation was the least in these categories, it further confirms that a majority of them answered within a close range.

With the above in mind, the results validate that users recognize Smart Cart to be useful and enjoyable. This entails that they believe the technology will enhance their shopping experience and that the usage itself is enjoyable apart from the performance consequences (Davis, 1989; Davis et al., 1992). The result of our survey shows that perceived enjoyment and usefulness both have strong correlations and effects amidst themselves and on perceived value as shown in figure 9. In accordance to our first and second hypothesis, this study proves that perceived benefits will have a positive influence on perceived value.

We have previously established that this study interprets value according to Zeithaml's (1988) definition, which describes value as the overall assessment of a product, depending on what is perceived to be given and taken. As theorized, perceived value has a significantly positive effect on not only adoption intention, but also on intention to use (Kim et al., 2007). Furthermore, value perception can be used as an indicator to predict and understand customer adoption behaviour as well as continuance intention (Yang et al., 2016).

With reference to our conceptual research model, we have been able to identify that perceived value correlates with intention to adopt and use. We observe that usefulness and enjoyment also influence this intention, though entirely indirectly through their effects on perceived value. Other than a positive interaction between perceived enjoyment and usefulness, they are observed to generate the biggest impact on Smart Cart usage and adoption overall. This indicates that the benefits drive the user to adopt and further use a new technology (Bruner & Kumar, 2005; Venkatesh, 2000).

Based on the results of the study, we predict that consumers are highly likely to adopt Smart Cart and use it to some extent in the future, validating our fifth hypothesis.

6.2 Assessment of The Hypotheses with Less Support

6.2.1 Perceived Difficulty to Use

A number of survey participants express a strong unwillingness to spend a lot of time and effort to learn a new technology (PDU2; PDU4), but this perception only has a strong internal correlation and loses its impact when applied to any other component of the research model. It is interesting to note that these two questions within perceived difficulty to use only refer to technology in general. Thus, we can conclude that this aspect of perceived difficulty to use is overlooked if the technology in question is considered enjoyable and useful.

Figure 8 shows that a majority of survey participants find vital importance in Smart Cart's ease of use and system efficiency, i.e. its ability to connect and load without error (PDU1; PDU3). Medium-strong correlations to perceived usefulness and perceived enjoyment show that this is especially important for those who recognize that Smart Cart to be useful in their life and believe the experience of using it to be enjoyable or pleasurable.

Lastly, the survey results illustrate another medium-strong correlation to the perceived value and the intention to adopt and use, proving that difficulty to use can have a negative influence on the value of Smart Cart, which in turn results in a potential inhibition of technology adoption.

Even though the survey results present medium-strong support of our fourth hypothesis, we want to draw attention to that this sacrificial component might be a dealbreaker. We predict that shoppers will probably stop using Smart Cart without consideration for the benefits, if the system is inefficient and the cart is continuously difficult to use.

Based on these results, we find partial support for hypothesis 4.

6.2.2 Perceived Privacy Risk

Unexpectedly, the perceived privacy risk does not have a strong negative impact on perceived value, essentially invalidating hypothesis 3 of this study. The survey results present weak correlations to the benefits, the perceived value, the intention to adopt and use as well as between the sacrifices. A strong correlation is found only within the privacy risk construct, which confirms that a certain number of survey participants have substantial privacy concerns, but simultaneously illustrates that the perceived privacy risks are more impacted by other factors rather than being a unit of impact itself.

Referring to Featherman et al. (2010), one of the reasons for this could be that Smart Cart is not within a financial or health sector. In this context, Smart Cart is less likely to be subject to privacy risks since its service is within the retail sector. Asides from in-store solutions such as location tracking, using the Smart Cart service will not require much more information than what is already required for a supermarket membership. So even if the Smart Cart, per se, is a privacy intrusive technology, it is considered less invasive in its context. The privacy risks associated with Smart Cart do not differ substantially from the current sacrifice components of its predecessors in supermarkets, which the consumers might perceive as marginal when adopting the technology. This interpretation is subject to reservation of further investigation,

since there are many different versions of the technology available and Smart Cart's data collection method is yet to be fully developed.

Another reason for less perceived privacy risk, can be the diminution of privacy concerns. Studies conducted by researchers like Featherman et al. (2010) and Inman and Nikolova (2017) endorse methods to outweigh the privacy concerns in addition to reducing the privacy risks, such as privacy calculus and corporate credibility or trust. These will be discussed in the two paragraphs beneath.

Firstly, this study advocates the privacy calculus to be the most poignant attribute to lessen the negative perception of privacy risks in relation to Smart Cart. The concept of privacy calculus can be described as the consumer's "give and take" estimation of the technology in question. Studies show that consumers are willing to submit to privacy-invading technologies, when the invasive attributes are countered by benefits (Posner, 1981; Smith et al., 2011). The meager correlation between benefits and privacy risk implies that perceived benefits exceed any potential risk. Thus, we suggest the privacy calculus to be the reason for the different outcome of hypothesis 3.

Secondly, since the Smart Cart concept has not arrived to the Scandinavian market, other than Finland, it is not yet known which companies will manufacture the cart or operate its services. Inman and Nikolova (2017) portray reputable companies as competitors with an edge, but this is an unexplored aspect of the Smart Cart with potential to change the perceived privacy risk - for better or for worse. Although, the consumers already recognise the credibility of the supermarket that they shop at, the likelihood of adoption has potential to lessen if there is no trust in the manufacturers or operators of Smart Cart. If the company is perceived as untrustworthy, unsafe or has a history of malpractice, we predict that privacy risk might turn out to be a factor that could reinforce the reality of sacrificial attributes such as perceived privacy risks and increase the negative impact on value for some users.

It seems that the combination of these two variables diminishes the perceived privacy risk, to the extent that it does not negatively influence the perceived value.

7 Conclusion

It could be gathered from the results that a majority of survey participants perceive Smart Cart to be of value and would be willing to use it. Through our conceptual model and the simulation of a new technology such as Smart Cart in a Scandinavian setting, we have been able to explore what factors influence consumer's intention to adopt, leading us to draw the following conclusions:

There is strong support for *Perceived Usefulness* to positively affect the *Perceived Value*.

There is strong support for *Perceived Enjoyment* to positively affect the *Perceived Value*.

There is weak support for *Perceived Privacy Risk* to negatively affect the *Perceived Value*.

There is partial support for *Perceived Difficulty to Use* to negatively affect the *Perceived Value*.

There is strong support for *Perceived Value* to positively affect the *Intention to Adopt and Use*.

Based on the outcome of these hypotheses, we are able to present some general findings such as follows:
Perceived benefits seem to be factors of greater impact rather than perceived sacrifices. Correspondingly, the perceived value seems to be more dependent on perceived usefulness and perceived enjoyment. If the benefits are perceived to be valuable enough, the perceived difficulty to use can be endured as long as the difficulties do not persevere. Although privacy concerns exist, perceived privacy risk does not have any negative influence on the perceived value given that privacy concerns are addressed or exceeded by benefits. Lastly, we find the overall value to be a significant construct when determining the likelihood of technology adoption and usage. This is also in line with previous conducted research in the context of introducing new technologies, which can induce digital transformations.

However, these generalisations would need to be tested within the context of other countries as it was narrowed down to a selection of Scandinavien countries. Furthermore, our survey was limited by the number of participants. To establish the findings a greater amount of and more evenly distributed participants across demographics would be preferable.

7.1 Future Research and Implications

A key challenge for our study approach has been to convey Smart Cart, its functions and its setting in a realistic way. Although the survey provided a description of the cart similar to the description in this study and a video demonstrating the functionality of it, it is questionable whether this kind of exposure is enough. Using a prototypical imitation still raises the question if this approach is enough for survey participants to form well-informed opinions and beliefs.

Additionally, as we have observed stronger support for the beneficial factors encouraging technology adoption, it would be of interest to further study consumer resistance and explore variables of sacrifice attributes more in-depth.

We hope our findings will lead to future research of digital transformation in conjunction with new technologies. This will be advantageous to researchers, corporations, consumers, users and the likes.

References

Andal-Ancion, A., Cartwright, P. A., & Yip, G. S. (2003). The digital transformation of traditional business. *MIT Sloan Management Review*, *44*(4), 34.

Arango, C., Huynh, K. P., Fung, B., & Stuber, G. (2012). The changing landscape for retail payments in Canada and the implications for the demand for cash. *Bank of Canada Review*, *2012*(Autumn), 31-40.

Backman, J. (2013). *Rapporter och Uppsatser*. Studentlitteratur, Lund.

Brennen, J. S., & Kreiss, D. (2016). Digitalization. *The International Encyclopedia of Communication Theory and Philosophy*, 1–11. doi:10.1002/9781118766804.wbiect111

Bruner, G. C., & Kumar, A. (2005). Explaining consumer acceptance of handheld Internet devices. *Journal of Business Research*, *58*(5), 553–558. doi:10.1016/j.jbusres.2003.08.002

Chang, Y., Dong, X., & Sun, W. (2014). Influence of Characteristics of the Internet of Things on Consumer Purchase Intention. *Social Behavior and Personality*, 42(2), 321-330. doi:10.2224/sbp.2014.42.2.321

Choi, J., Peters, M., & Mueller, R. O. (2010). Correlational analysis of ordinal data: from Pearson's r to Bayesian polychoric correlation. *Asia Pacific Education Review*, *11*(4), 459–466. doi:10.1007/s12564-010-9096-y

Davis, F.D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, Vol. 13 No. 3, pp. 319-340.

Davis, F.D. (1993). User acceptance of information technology: system characteristics, user perceptions and behavioral impacts. *International Journal of Man-Machine Studies* , Vol. 38 No. 3, pp. 475-487.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1992). Extrinsic and Intrinsic Motivation to Use Computers in the Workplace1. *Journal of Applied Social Psychology*, *22*(14), 1111–1132. doi:10.1111/j.1559-1816.1992.tb00945.x

Denscombe, M. (2014). *Forskningshandboken: För småskaliga forskningsprojekt inom samhällsvetenskaperna*. Studentlitteratur, Lund.

Dong, X., Chang, Y., Wang, Y., & Yan, J. (2017). Understanding usage of Internet of Things (IOT) systems in China: Cognitive experience and affect experience as moderator. *Information Technology & People*, Vol. 30 No. 1, pp. 117-138. doi:10.1108/ITP-11-2015-0272

Featherman, M. S., Miyazaki, A. D., & Sprott, D. E. (2010). Reducing online privacy risk to facilitate e-service adoption: The influence of perceived ease of use and corporate credibility. *The Journal of Services Marketing*, 24(3), 219-229. doi:10.1108/08876041011040622

Gao, L., & Bai, X. (2014). A unified perspective on the factors influencing consumer acceptance of internet of things technology. *Asia Pacific Journal of Marketing and Logistics, 26*(2), 211-231. doi:10.1108/APJML-06-2013-0061

Heavin, C., & Power, D. J. (2018). Challenges for digital transformation – towards a conceptual decision support guide for managers. *Journal of Decision Systems*, *27*(sup1), 38–45. doi:10.1080/12460125.2018.1468697

Henriette, E., Feki, M., & Boughzala, I. (2016). Digital Transformation Challenges. In *MCIS* (p. 33).

Hsu, C.-L., & Lin, C.-C. (2016). An empirical examination of consumer adoption of Internet of Things services: Network externalities and concern for information privacy perspectives. Computers in Human Behavior, 62, 516–527. doi:10.1016/j.chb.2016.04.023

Hsu, C. L., & Lin, J. C. C. (2018). Exploring factors affecting the adoption of internet of things services. *Journal of Computer Information Systems*, *58*(1), 49-57. doi:10.1080/08874417.2016.1186524

ICA. (n.d.). *Självscanning*. Retrieved May 13, 2020, from https://www.ica.se/butiker/service-i-butiker/sjalvscanning/.

Ingene, C. (2013) Retail evolution Historical facts, theoretical logic and critical thinking Journal of historical Research in Marketing, 2014, vol 6, Issue 2, pp 279-299. doi:10.1108/JHRM-12-2013-0067

Inman, J. J., & Nikolova, H. (2017). Shopper-Facing Retail Technology: A Retailer Adoption Decision Framework Incorporating Shopper Attitudes and Privacy Concerns. *Journal of Retailing*, 93(1), 7–28. doi:10.1016/j.jretai.2016.12.006

Kim, H. W., Chan, H. C., & Gupta, S. (2007). Value-based adoption of mobile internet: an empirical investigation. *Decision support systems*, *43*(1), 111-126. doi:10.1016/j.dss.2005.05.009

Kim, Y., Park, Y., & Choi, J. (2017). A study on the adoption of IoT smart home service: using Value-based Adoption Model. Total Quality Management & Business Excellence, 28(9-10), 1149-1165. doi:10.1080/14783363.2017.1310708

Kumar, V., & Reinartz, W. J. (2018). *Customer relationship management: concept, strategy, and tools: 3rd ed*. Berlin: Springer-Verlag.

Kärrholm, M., & Nylund, K. (2011). Escalating consumption and spatial planning: Notes on the evolution of Swedish retail spaces. *European Planning Studies*, *19*(6), 1043-1059.

Laerd.com (n.d.). *Guidelines to interpreting Pearson's correlation coefficient.* Retrieved May 1, 2020, from https://statistics.laerd.com/statistical-guides/pearson-correlation-coefficient-statistical-guide.php.

Laudon, K. C., & Laudon, J. P. (2018). *Management information systems: Managing the digital firm.* Harlow, England: Pearson.

Lemon, K. N., & Verhoef, P. C. (2016). Understanding customer experience throughout the customer journey. *Journal of marketing*, *80*(6), 69-96.

Lee, Y.-K., Park, J.-H., Chung, N. and Blakeney, A. (2012), "A unified perspective on the factors influencing usage intention toward mobile financial services", Journal of Business Research, Vol. 65 No. 11, pp. 1590-1599.

Liao, C., Liu, C. C., & Chen, K. (2011). Examining the impact of privacy, trust and risk

perceptions beyond monetary transactions: An integrated model. *Electronic Commerce Research and Applications*, *10*(6), 702-715. doi:10.1016/j.elerap.2011.07.003

Lin, T.-C., Wu, S., Hsu, J. S.-C., & Chou, Y.-C. (2012). The integration of value-based adoption and expectation–confirmation models: An example of IPTV continuance intention. *Decision Support Systems*, *54*(1), 63–75. doi:10.1016/j.dss.2012.04.004

Lindström, K. (2018, November 2). Akademibokhandelns cio räds inte hotet från Amazon. *DGI Sverige*. Retrieved February 16, 2020, from https://cio.idg.se/2.1782/1.709673/akademibokhandelns-cio-amazon.

Mani, Z & Chouk, I. (2017). Drivers of consumers' resistance to smart products. *Journal of Marketing Management*, 33:1-2, 76-97. doi:10.1080/0267257X.2016.1245212

Matt, C., Hess, T., & Benlian, A. (2015). Digital transformation strategies. *Business & Information Systems Engineering*, *57*(5), 339-343.

Piotrowicz, W., & Cuthbertson, R. (2014). Introduction to the special issue information technology in retail: Toward omnichannel retailing. *International Journal of Electronic Commerce*, *18*(4), 5-16.

Posner, R. (1981). The Economics of Privacy. *The American Economic Review, 71*(2), 405-409. Retrieved May 8, 2020, from www.jstor.org/stable/1815754.

Riksbanken. (2018). *Svenska folkets betalningsvanor 2018*. Retrieved from https://www.riksbank.se/globalassets/media/statistik/betalningsstatistik/2018/svenska-folkets-betalningsvanor-2018.pdf.

Rogers, E. M. (2003). *Diffusion of Innovation: 5th ed*. New York: The Free Press.

Rauniar, R., Rawski, G., Yang, J., & Johnson, B. (2014). Technology acceptance model (TAM) and social media usage: An empirical study on Facebook. *Journal of Enterprise Information Management, 27*(1), 6-30. doi:10.1108/JEIM-04-2012-0011

Smartcart. (2019, January 29). *SMARTCART is your personal shopping assistant* [Video file]. Retrieved from https://youtu.be/2NVZv2hFoQo.

Smartcart. (n.d.). *About*. Retrieved February 16, 2020, from https://www.smartcart.fi/about/.

Smith, H., Dinev, T., & Xu, H. (2011). Information Privacy Research: An Interdisciplinary Review. *MIS Quarterly, 35*(4), 989-1015. doi:10.2307/41409970

Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach's alpha. *International journal of medical education*, *2*, 53–55. doi:10.5116/ijme.4dfb.8dfd

Venkatesh, V. (2000). Determinants of Perceived Ease of Use: Integrating Control, Intrinsic Motivation, and Emotion into the Technology Acceptance Model. *Information Systems Research,11*(4), 342-365. Retrieved May 9, 2020, from www.jstor.org/stable/23011042

Visma. (2017). *Självscannare är mer lojala kunder.* Retrieved February 16, 2020, from https://media.visma.se/pressreleases/sjaelvscannare-aer-mer-lojala-kunder-1770485.

Wuenderlich, N. V., Heinonen, K., Ostrom, A. L., Patricio, L., Sousa, R., Voss, C., & Lemmink, J. G. A. M. (2015). "Futurizing" smart service: Implications for service researchers and managers. Journal of Services Marketing, 29(6/7), 442–447. doi:10.1108/JSM-01-2015-004

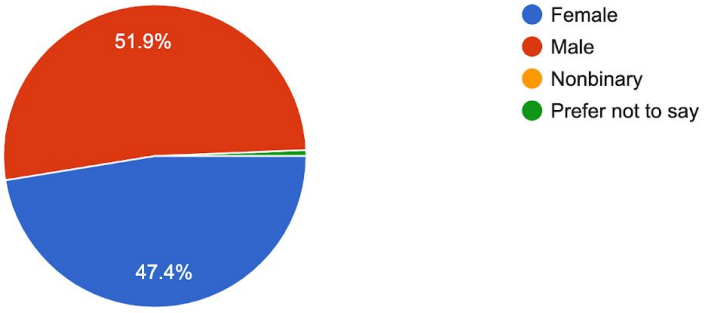
Xu, H., & Gupta, S. (2009). The effects of privacy concerns and personal innovativeness on potential and experienced customers' adoption of location-based services. *Electronic Markets*, *19*(2-3), 137–149. doi:10.1007/s12525-009-0012-4

Zeithaml, V. A. (1988). Consumer Perceptions of Price, Quality, and Value: A Means-End Model and Synthesis of Evidence. *Journal of Marketing*, *52*(3), 2–22. doi:10.1177/0022242988052003

Appendix A - Survey Answers

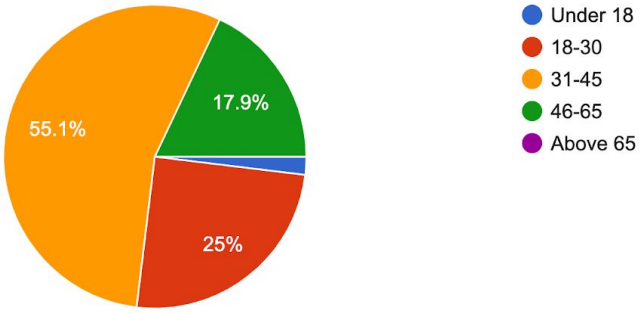
What gender do you identify with?

156 responses



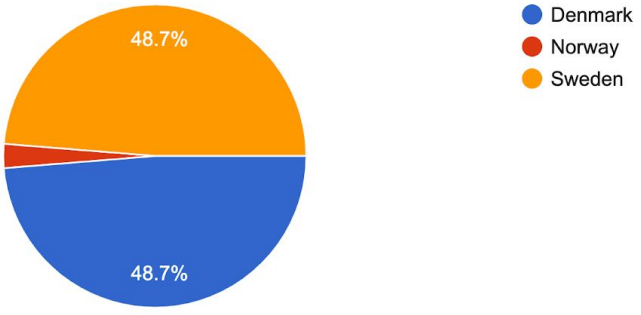
How old are you?

156 responses



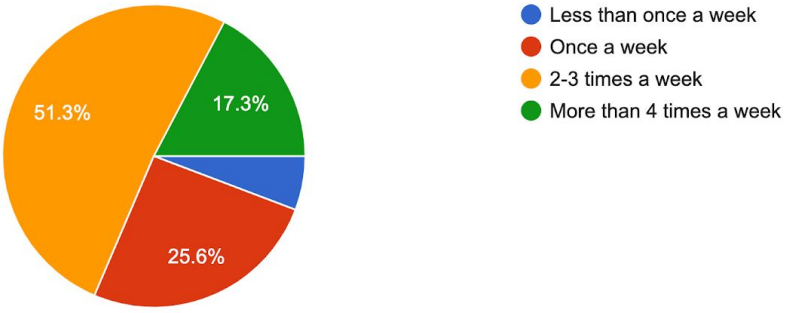
Which country do you reside in?

156 responses



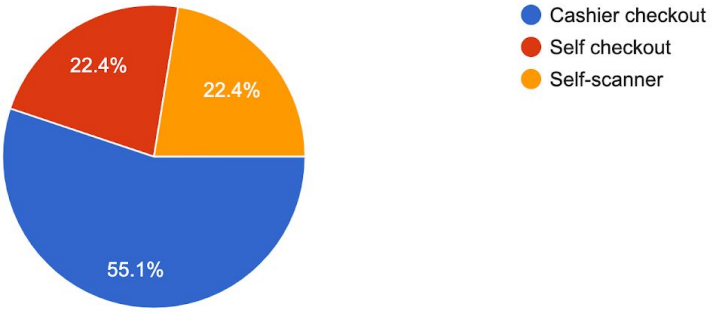
How often do you visit the supermarket?

156 responses



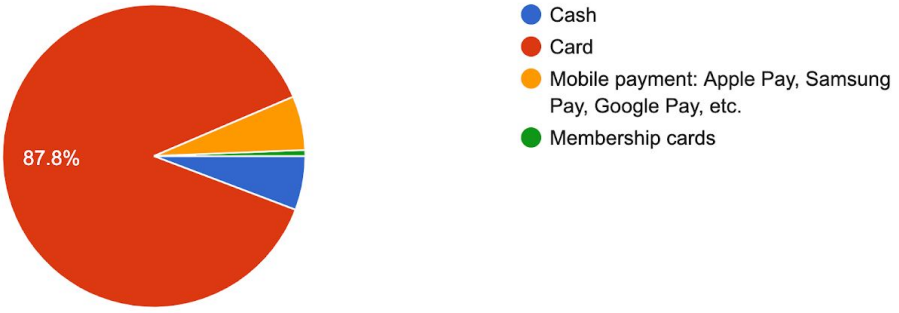
How do you check out your groceries most often?

156 responses



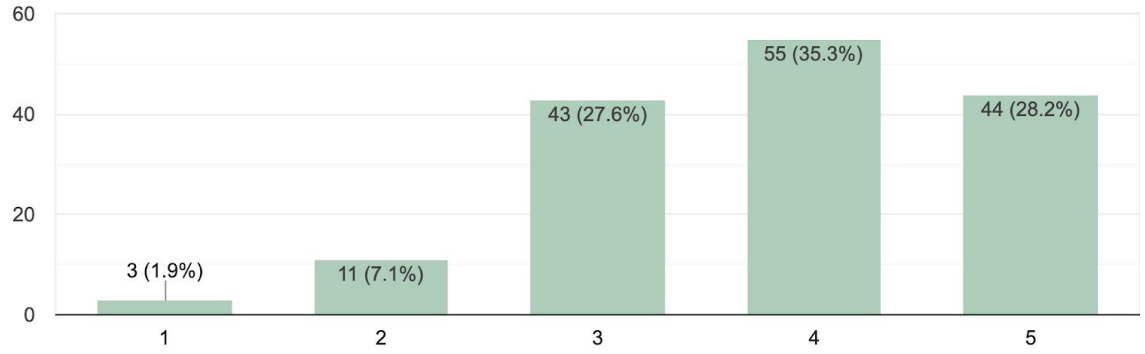
How do you pay for your groceries most often?

156 responses



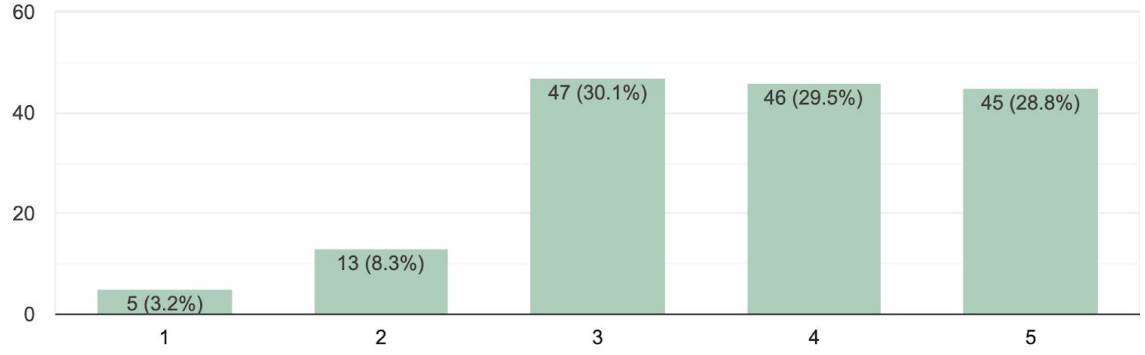
Using the Smart Cart would enable me to finish grocery shopping more quickly.

156 responses



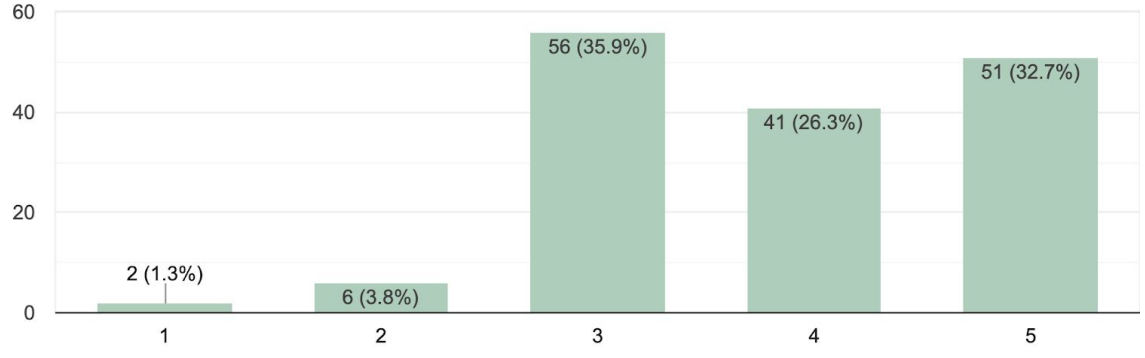
Using the Smart Cart functions such as access to over 6000 recipes, access to product information, product location and navigation thro...the quality or output of my shopping experience.

156 responses



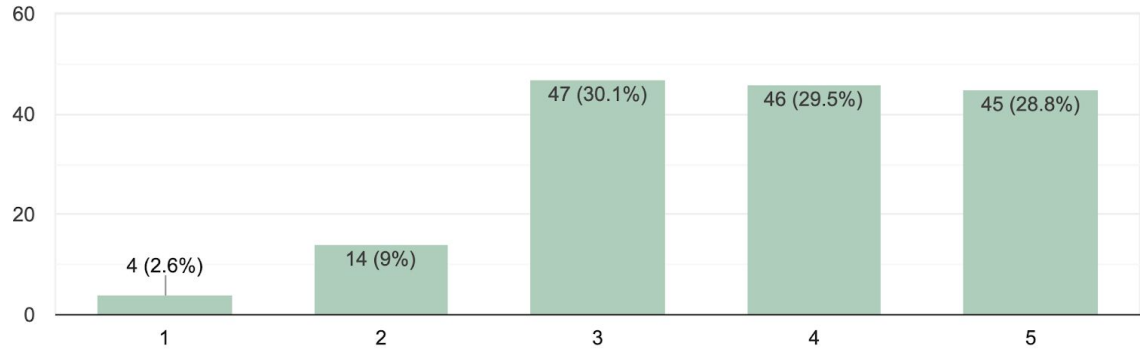
Smart Cart would provide a very useful service and information about my groceries to me.

156 responses



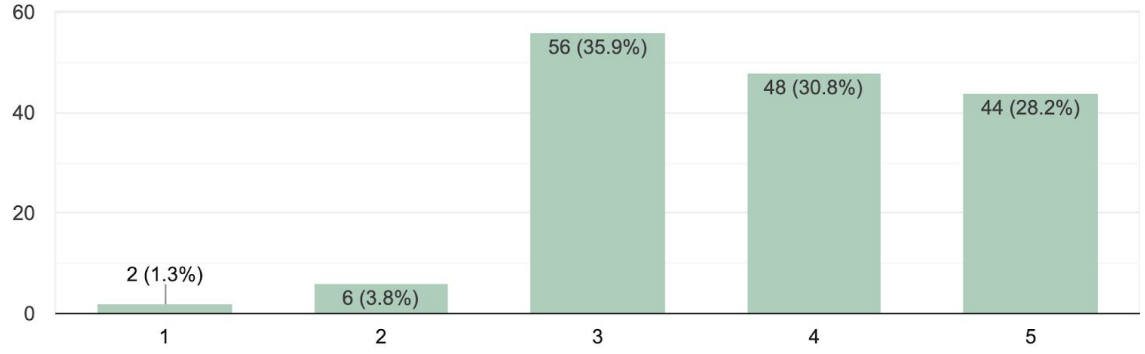
Overall, I believe that using the Smart Cart would be useful in my life.

156 responses



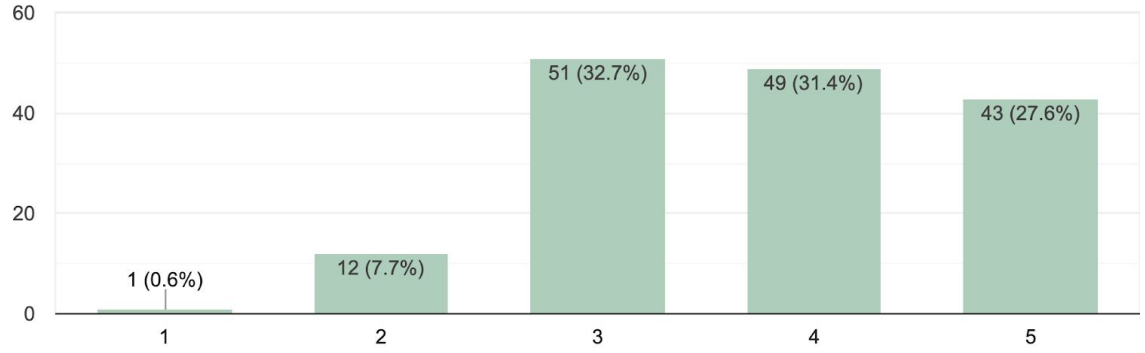
The process of using the Smart Cart service would be enjoyable.

156 responses



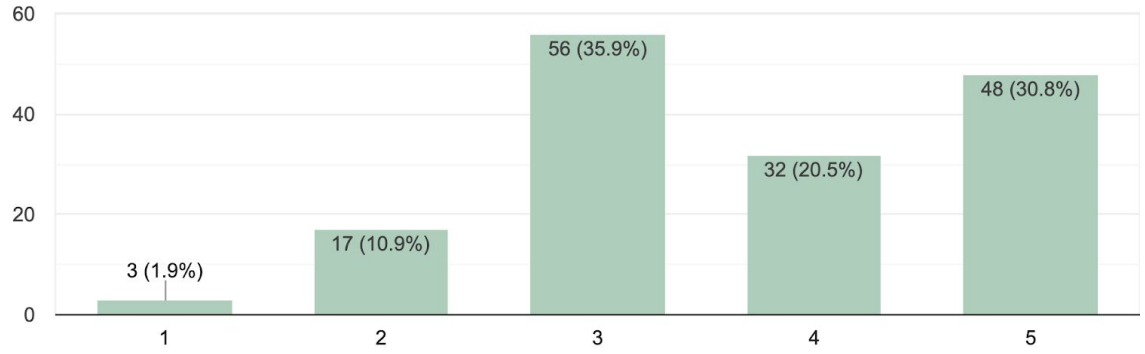
The use of Smart Cart would be a pleasurable experience.

156 responses



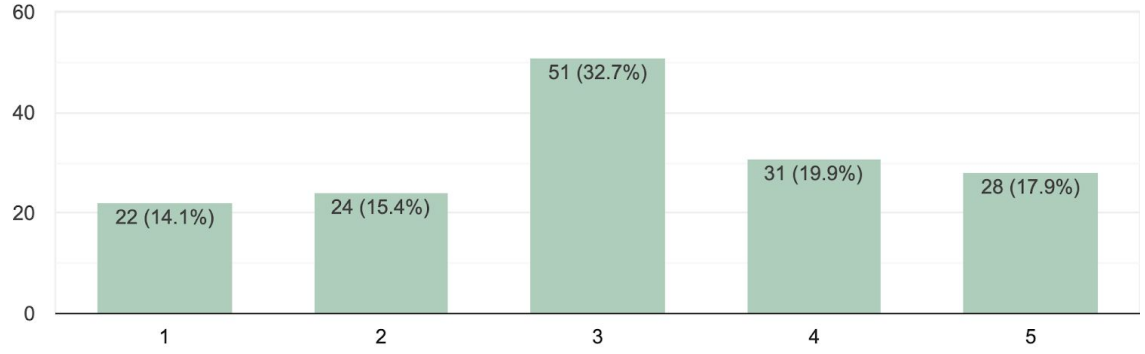
I would have fun using the Smart Cart service.

156 responses



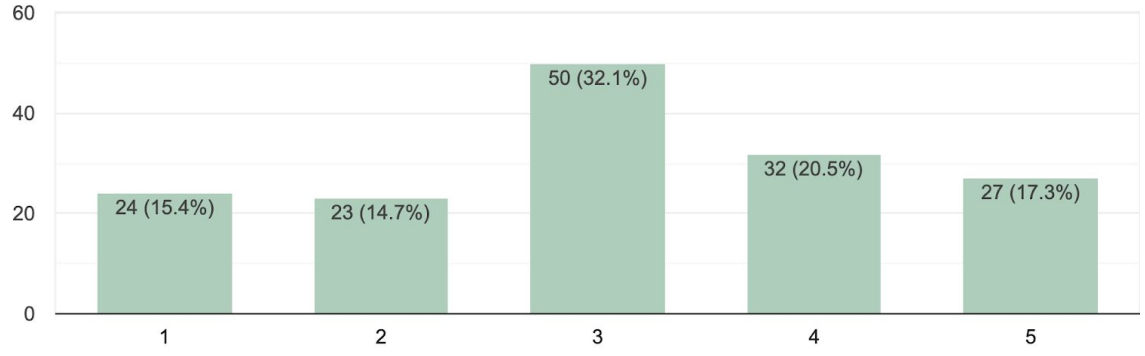
I am concerned that the Smart Cart will collect too much data about me.

156 responses



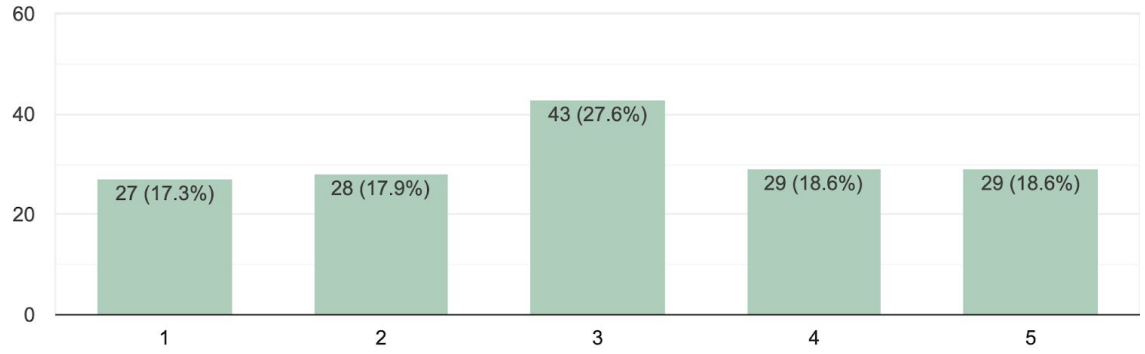
I am concerned that the collected data might be used in an unintended way.

156 responses



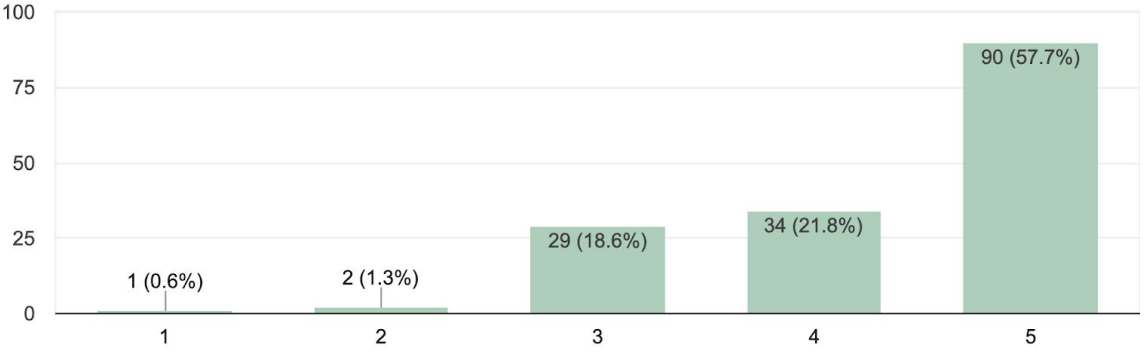
I am worried that the use of Smart Cart will lead to a loss of privacy.

156 responses



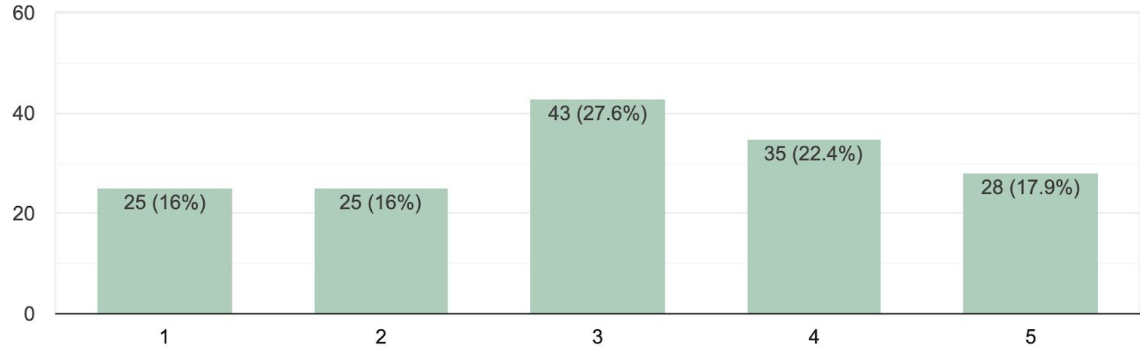
It is of vital importance to me that the Smart Cart is easy to use.

156 responses



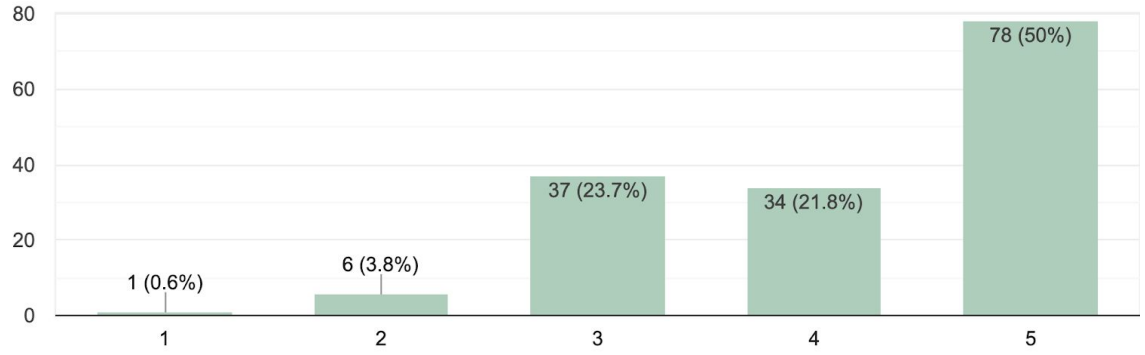
I am not always willing to make an effort to learn a new technology.

156 responses



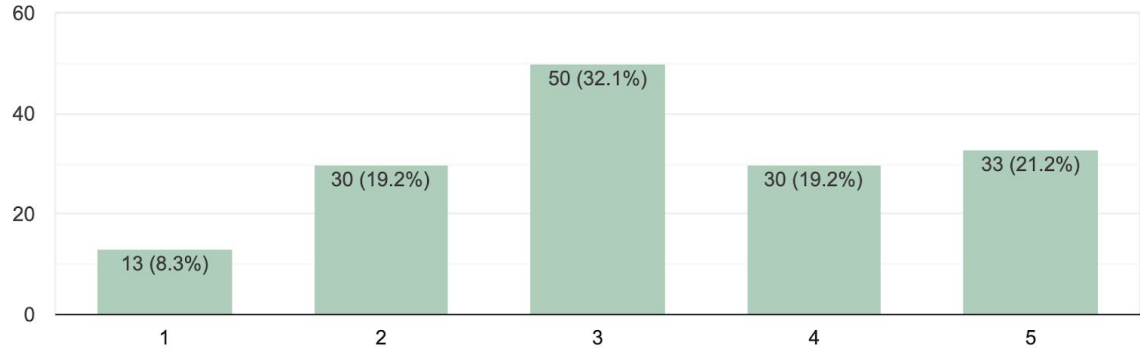
System efficiency (its ability to connect and load without an error) is important to me while trying out the Smart Cart.

156 responses



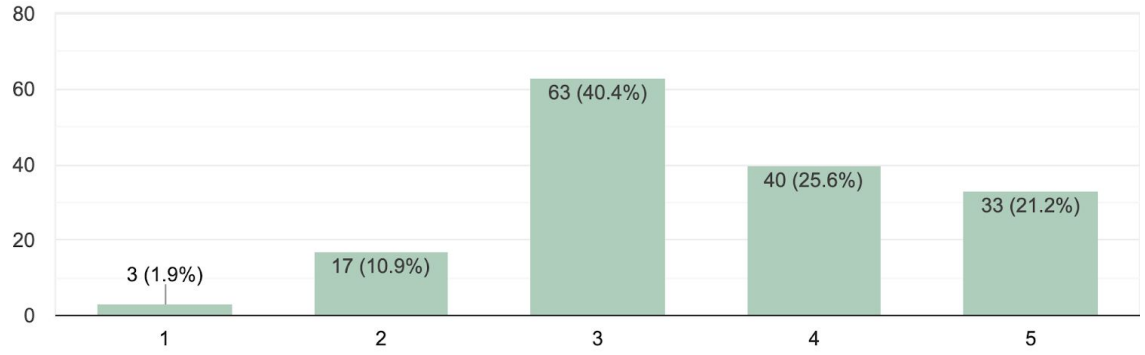
I am not likely to spend a lot of time in order to learn a new technology.

156 responses



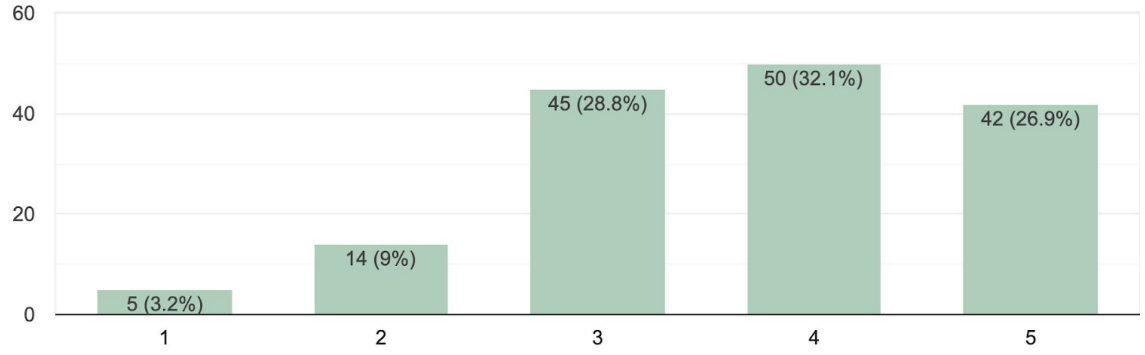
Compared to the effort and time I need to put in to learn the ways of new technology, in this case, the Smart Cart, I consider the use of this technology beneficial to me.

156 responses



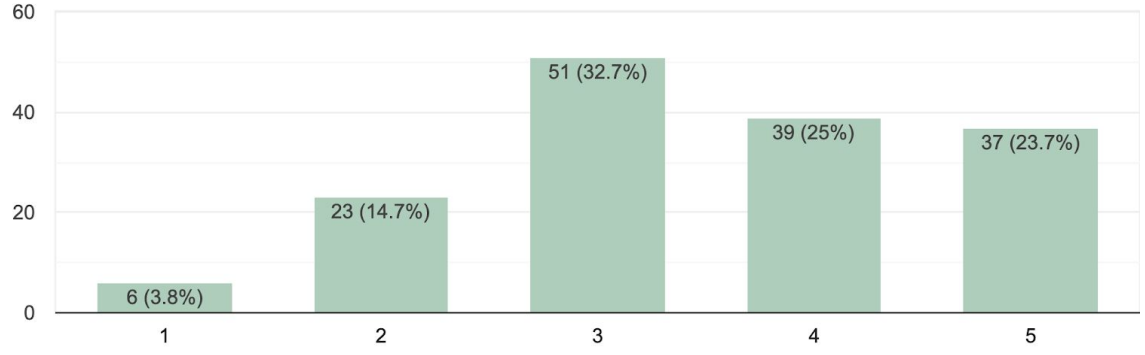
Smart Cart will make the shopping experience easier for me.

156 responses



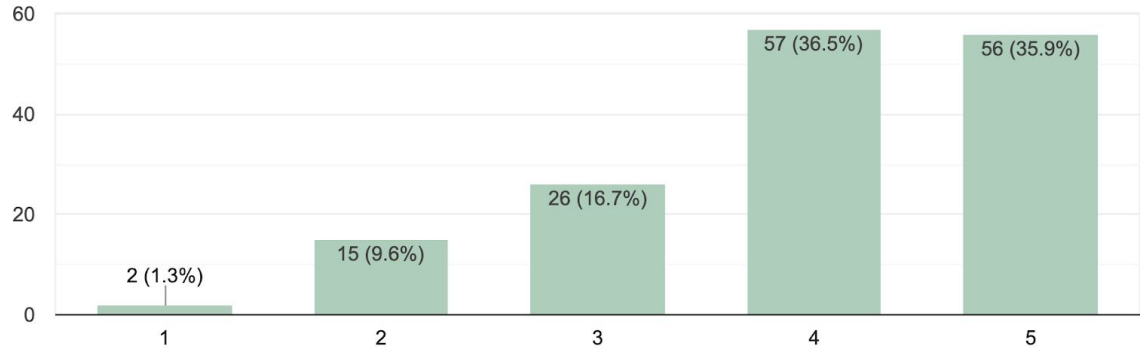
I intend to recommend my friends to use Smart Cart in the future.

156 responses



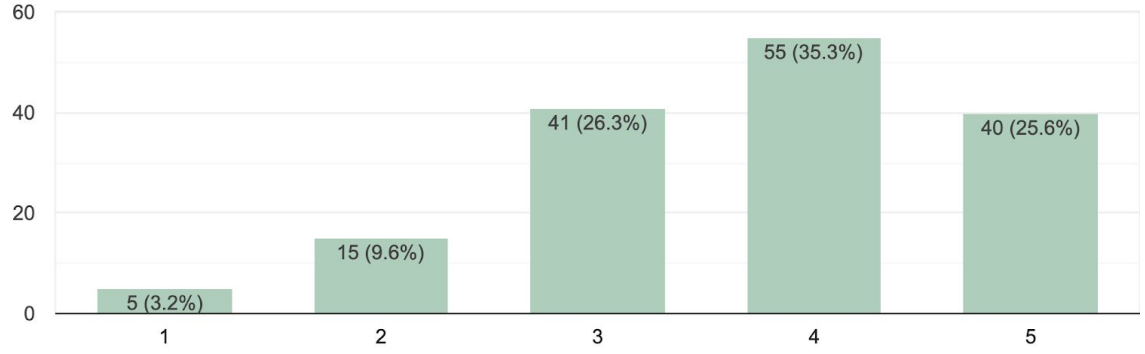
I intend to give Smart Cart a chance in the future.

156 responses



I predict that I will use Smart Cart in the future.

156 responses



I will frequently use Smart Cart in the future.

156 responses