Aalto University
School of Business

The Adoption of Retail Self-Service Checkout Systems - An Empirical Study Examining the Link between Intention to Use and Actual Use

Information Systems Science

Master's thesis

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2013

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AALTO UNIVERSITY SCHOOL OF BUSINESS ABSTRACT

Department of Information and Service Economy 15.08.2013

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ABSTRACT

Objectives of the study

Self-service technologies (SSTs) are becoming increasingly essential drivers of business success. A large-scale utilization tends to be a prerequisite for a successful information technology (IT) investment. This study investigates the determinants of technology adoption in the case of self-service checkouts (SCOs) in Finnish grocery stores. The objectives are to confirm the determinants of intention to use SCOs, examine the link between behavioral intention to use and actual use, and study how a contextual variable may act as a trigger that turns the intention into actual use. In addition, the influence of some relevant control variables is taken under scrutiny.

Academic background and methodology

The study builds itself on the technology acceptance theory (Davis, 1989) by formulating a research model to explain the acceptance of SCOs. The core TAM model is extended by adding some context-specific variables based on the current research setting and previous literature on technology adoption. Method of research is a large-scale empirical study in the form of a consumer survey. Nine research hypotheses are formulated and tested with a sample of 1534 survey responses collected with a longitudinal study. Collected data is analyzed using Structural Equation Modeling (SEM) technique Mplus 6.1.

Findings and conclusions

The research hypotheses are supported and the link between intention to use and actual use is confirmed. Findings suggest that the contextual variable, perceived waiting time, strongly moderates the relationship between intention to use and actual use. While a consumer may have a high intention to use the technology, it is less likely to turn into actual use without a contextual trigger. Thus, such activation mechanisms should generally be taken into account when investing in technology. In addition, preference of cash payment option was negatively related to intention to use SCOs, which might be caused by the lack of cash payment option in the SCO systems used in the sites of this study. Prior experience of SCO usage has a significant effect on its adoption, so to maximize utilization retailers should find ways to get consumers to trial SCO systems for the first time.

Keywords

Intention, adoption, contextual trigger, self-checkout, SEM, SST, technology

AALTO-YLIOPISTON KAUPPAKORKEAKOULU TIIVISTELMÄ

Tieto- ja palvelutalouden laitos 15.08.2013

Pro Gradu-tutkielma

Tapani Rinta-Kahila

ABSTRAKTI

Tutkimuksen tavoitteet

Itsepalveluteknologian käyttöönotosta on tullut kilpailuvaltti ja jopa elintärkeä tekijä lukuisilla liiketoiminnan alueilla. Jotta kallis tietojärjestelmäinvestointi maksaisi itsensä takaisin, on sen käyttöaste saatava riittävän korkeaksi. Tämän tutkimuksen tavoitteena on tutkia tekijöitä, jotka vaikuttavat uuden teknologian käyttöönottoon, tässä tapauksessa ruokakauppojen itsepalvelukassojen käyttöaikomukseen ja käyttöön. Tutkimuksen päätavoitteina on määrittää käyttöaikomuksen syntymiseen vaikuttavat tekijät, tutkia käyttöaikomuksen ja toteutuneen käytön välistä suhdetta sekä tilanteellisen tekijän vaikutusta edellä mainittujen väliseen suhteeseen. Olennaiset teknologian käyttöön vaikuttavat taustatekijät otetaan huomioon kontrollimuuttujina.

Kirjallisuuskatsaus ja metodologia

Tutkimuksen teoriapohja perustuu aiempaan kirjallisuuteen teknologian omaksumisesta, erityisesti Technology Acceptance Model -teoriaan (Davis 1989). TAM:n ydinmallia on laajennettu vastaamaan paremmin tämänhetkistä tutkimuskontekstia. Tutkimus on toteutettu laajamittaisen kuluttajakyselyn muodossa, kahden mittauspisteen pitkittäistutkimuksena. Tutkimusmalliin perustuvia yhdeksää hypoteesia testataan 1534 kyselyvastauksesta muodostuvalla aineistolla käyttämällä rakenneyhtälömallinnusta ohjelmassa Mplus 6.1.

Tulokset ja päätelmät

Kerätty aineisto tukee tutkimushypoteeseja ja vahvistaa TAM-teorian paikkansapitävyyden. Tuloksista selviää, että tilanteellinen tekijä, tässä tapauksessa odotusaika, vahvistaa merkittävästi käyttöaikomuksen johtamista toteutuneeseen käyttöön. Käyttöaikomus toteutuu huomattavasti todennäköisemmin, mikäli jokin kontekstuaalisesti relevantti tilannetekijä toimii ”laukaisimena” käytölle. Itsepalvelukassan käytön arvioitu hyödyllisyys, helppokäyttöisyys ja hauskuus lisäävät käyttöaikomusta, halu maksaa käteisellä taas pienentää sitä. Tämä saattaa johtua siitä, että tällä hetkellä käytössä olevissa itsepalvelukassoissa ei ole mahdollisuutta maksaa käteisellä. Aiempi kokemus kyseisen teknologian käytöstä vahvistaa huomattavasti käyttöaikomusta sekä käyttöä.

Avainsanat

Käyttöaikomus, itsepalveluteknologia, itsepalvelukassa, rakenneyhtälömalli

AKNOWLEDGEMENTS

I would like to thank my supervisors Esko Penttinen and Timo Saarinen for their dedicated and supportive guidance during the research process. As importantly, I want to thank Mikko Rönkkö for his input on methodological issues and data analysis.

Special thanks go to Salla Tenkanen from New Vision Inco for offering me the thesis assignment and providing me valuable consultation and practical assistance. Lastly, I want to thank S-Group and Kesko for the proficient collaboration in the data collection phase.

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LIST OF ABBREVIATIONS

ATM = Automatic Teller Machine

CFA = Confirmatory Factor Analysis

IT = Information Technology

PLS = Partial Least Squares

SCO = Self-Service Checkout

SST = Self-Service Technology

SEM = Structural Equation Modeling

TAM = Technology Acceptance Model

TRA = Theory of Reasoned Action

TPB = Theory of Planned Behavior

UTAUT = Unified Theory of Acceptance and Use of Technology

1. INTRODUCTION

1.1. Background

During the 1990s and 2000s, the use of technology-based service delivery options has increased remarkably. With the facilitation of technology, the need for personal service carried out by service personnel is becoming less significant. Thus, a trend toward customers producing services themselves has emerged both in workplaces and in consumer markets. Technology has radically altered the meaning of service. Traditionally, service has been viewed strictly as something that is provided by employees for customers but nowadays service is increasingly co-created and developed by both employees and customers.

Self-service technologies (SSTs) can be defined as technology-based solutions that allow a customer to produce a service without a direct involvement of a service employee (Meuter et al., 2000, 50). Companies may achieve improved productivity and service quality while cutting costs through a successful implementation of SST solutions (Weijters et al., 2007, 4). The use of technological solutions has indeed transformed business processes and changed the concept of service (Meuter et al., 2005, 50). Technological innovations have enabled basically anyone to perform certain activities that were previously confined to workforce specially trained to use a technology (Cavanagh, 2006). SSTs appear in numerous forms and are found in different retail environments, such as banking, hotels, airlines and retail stores. As some SSTs, such as automated teller machines (ATMs), internet banking, and pay-at-the-pump gas stations have been self-evident for a while now, new innovative forms of SSTs continue to emerge. While consumers are already managing their finances via internet banking instead of going to a bank counter, mobile internet banking services have been recently introduced to smartphones. Moreover, retail store chains have invested in self-service checkouts (SCOs) that save personnel costs, help dealing with demand fluctuations without the need of adjusting employee levels, and standardize the service process.

1.2. Motivation and scope of the study

Technological innovations are expected to continue gaining significance as a key criterion of long-term business success (Meuter, 2000, 50). However, SST investments, like information technology investments in general, are prone to be unprofitable due to high implementation costs and low utilization rates. For instance, Dean (2008) found that as much as 40 % of consumers used a store's self-checkout option only 15 % of the time or less when the option was available. Also resistance toward new technology tends to be high especially among elder people according to Dean (2008), which increases the risk of an SST investment to turn out unsuccessful. If the system is underutilized, it pays the invested money back slowly (if at all) and leads to ever-increasing labor costs. An SST investment becomes economically feasible only when the labor cost savings from the replaced employees equal the cost of implementation and maintenance of the system (Dean, 2008). Furthermore, SST investment costs may be high and investment's success can have a great impact on an organization's future. Therefore, examining the factors influencing the technology acceptance is a critical research topic. Further understanding of the antecedents that determine utilization of SST is necessary for any industry that seeks to gain performance improvement.

This study concentrates on consumers' SCO adoption in Finland's grocery retail environment. The research topic is highly current, as SCO pilot projects have just recently initiated by Finland's leading grocery retailers S-Group and Kesko. Gaining more knowledge on how differences in consumer characteristics influence SCO acceptance can help retailers making decisions about investing in SCO systems and to better understand which types of consumers are likely to use an SCO option (Lee, 2010). The present study is limited to the acceptance of self-service checkouts in grocery retail environment. Alternative emerging retail SSTs such as Radio Frequency Identification (RFID) and Near Field Communication (NFC) are limited outside of this research context. Although most of the new payment terminals in retail stores include the possibility for applying NFC payment technology, it is not yet being utilized in the stores at the time of writing this.

1.3. Research gap and objectives

Technology adoption has been widely researched in the field of operations management. During the last couple of decades researchers have developed behavioral theories trying to explain the intention to use a certain technology and the relationship between the intention and actual use. These theories, such as the Theory of Reasoned Action and the Technology Acceptance Model have been extensively applied in studying the adoption of self-service technologies.

The theoretical foundations of this study lay in the Technology Acceptance Model (discussed in Chapter 2.2), which has proven useful in the research of SST adoption. However, as the majority of studies have been limited to investigate the determinants of intention to use SSTs, the connection between intention to use and actual use has not been addressed nearly to the same extent. The probable reason for this is the practical difficulty of gathering data on both intention and behavior in different measurement points and then connecting the individual responses so that the link between the two variables can be confirmed. A number of longitudinal studies about information technology acceptance with more than one measurement points have been executed in the IS research field (e.g. Davis, 1989; Venkatesh et al. 2003; Venkatesh and Zhang, 2010). However, in the SST field the studies rarely include the relation between behavioral intention and actual behavior into the research structure, nor do they examine the other possible determinants of actual system use. Some studies have addressed these issues when investigating the adoption of SSTs such as mobile banking and e-invoicing (e.g. Keeton, 2008; Juntumaa and Öörni, 2011; Yu, 2012). It seems that a research conducted by Weijters et al. (2007) is by far the only one that has investigated the determinants of actual SCO use in grocery retail store setting. Thus, further research is called for.

Weijters et al. (2007) recognize that their study is limited to what happens during one single shopping trip so its generalizability is limited. The present study aims to tackle this limitation by confirming the link between behavioral intention to use and actual use in a more generalizable way. It is argued here that the development of usage behavior can be a process that does not happen at instant but takes some time to develop. Moreover, Weijters et al. (2007) and Meuter et al. (2000) are one of the few who have investigated the relationship between the use of SST and the customer satisfaction. This is one contribution that the present study aims to offer. Even a

brief review of discussion on the Internet implies that the introduction of SCOs divides opinions radically and seems to produce both happy and unhappy customers for stores. As customer satisfaction has been proven to lead to customer retention and increased profit streams, this issue is worth of examination (Anderson & Mittal, 2000). Thus, customer satisfaction in relation to SCOs will be addressed as an attempt to fill this gap in the research field.

Another key objective of the present study is to investigate the influence of a moderating situational variable, perceived waiting time to SCO option. This variable is expected to moderate the relationship between intention to use the system and actual system use. Waiting time has been addressed before in earlier work on SCO adoption but as with the majority of TAM studies, the investigation has usually been limited to its effect on intention to use. In addition, the framework of this study includes control variables that are expected to influence the determinants of SCO adoption. The effects of demographic factors age and gender are addressed, as well as the effect of psychographic factor; need for interaction with a service employee. Furthermore, a background variable adopted from Venkatesh et al. (2003) is introduced here: prior experience of using the system. Majority of SCO adoption studies have not considered this antecedent factor and it is argued here that segmenting consumers based on their prior experience of SCOs may give us fresh insights.

SCO technology has only recently emerged in Finland's grocery stores, so very little previous Finnish research exists on this field. The master's thesis by Uitto (2011) is so far the only consumer research about SCOs conducted in Finland. All in all, the present study aims to address the following questions:

- What are the determinants of intention to use SCOs in retail grocery environment?
- Does intention to use SCOs lead to actual use of SCOs?
- How does perceived waiting time moderate the relationship between intention to use and actual use?

1.4. SCOs in Finland's retail environment

According to Nielsen Holdings (2013), grocery retail markets in Finland are strongly dominated by two main players, S-group and Kesko, with market shares of 45.6 % and 34.7 %, respectively. These two dominant actors have been able to increase their market shares since 2009, while the market shares of smaller actors have been diminishing (Björkroth et al., 2012, 11). As in 2012 S-group and Kesko held a combined share of 80.3 % of the Finnish grocery retail market, the rest is divided among smaller actors, most remarkably with Suomen Lähikauppa Oy (7.3 %) and Lidl (5.5 %) (Nielsen Holdings, 2013).

Globally, intense competition in the retail market has driven grocery chains to seek cost savings by embracing self-service technology. During the last decade, self-service checkouts have been widely implemented in grocery stores throughout Europe, Americas and Asia. SCOs have acquired a strong foothold especially in the United States, Canada, Mexico, and South-America, as the Americas together account for 47.9 % of the global market for self-checkout solutions (Gardner and Nathanson, 2008). On the contrary, the emergence of retail self-checkout solutions in Finland has been relatively slow, if almost nonexistent. In the end of 1990s, the SCO technology was experimented in some S-Market stores in Finland but the technology was abandoned then due to the experience that neither the technology nor the customers were yet ready for fully embracing self-service in the checkout process.

The reasons for the dragging utilization may very well stem from the exceptionally concentrated retail market structure discussed above. While two big players dominate the market shares, there simply might not be sufficient incentives to seek cost-advantages through expensive and potentially risky investments. The lack of dynamics in the market environment has probably had a "softening" effect of some extent on the competition, as Björkroth et al. (2012) suggest. In addition, the agent of Finland's trade union Matti Räisänen has commented the issue saying that "the technology does exist but is very expensive" and he also expressed the union's concern of SCOs provoking theft (*Helsingin Sanomat*, 8.3.2012). Nevertheless, the situation is about to change, as S-Group and Kesko have recently rebooted the SCO concept in their grocery stores.

Before 2012, furniture and home accessory chain Ikea was the only retail store in Finland that had an SCO option in use. Due to advancements in retail SCO technology during the last ten

years, new SCO pilot projects were started in 2012 by both S-Group and Kesko. Fujitsu is the POS supplier for both Kesko and S-Group and therefore the integrator for their SCO software solution. Fujitsu is also the SCO SW/HW (software and hardware) supplier for S-group, while Wincor Nixdorf is the SCO software and kiosk hardware supplier and Motorola the hand-scanner supplier for Kesko. The technical solutions applied now are finally considered reliable and user-friendly enough to be fit for large scale utilization in Finland.

1.5. Types of SCOs in use

At the time of initiating the present study, there were three grocery retail stores in Finland that had the self-checkout option available. These three stores investigated in this study are referred to as Site 1, Site 2, and Site 3. Site 1 is located in the capital Helsinki, Sites 2 and 3 in a smaller city, Lahti. Sites 1 and 2 are medium-sized supermarket stores, and Site 3 is a large hypermarket store. Characteristics of the three sites are compiled in Table 1.

Table 1: Sites of the study

Site	Location	Type of SCO	Size
Site 1	City (Helsinki)	SCO kiosk	Supermarket
Site 2	Small city (Lahti)	SCO kiosk	Supermarket
Site 3	Small city (Lahti)	SCO kiosk & SCO with cart scanner	Hypermarket

Two different types of SCO systems are currently in use in these grocery stores. The kiosk SCO solution without a scanner cart is being used in Sites 1 and 2. This solution consists of till kiosks at the checkout area illustrated in Figure 1, where customers can self-scan and pay for the groceries using the SCO system. A customer scans the items and places them on a sensitive scale on the side of the till. The scale checks whether the scanned items match with the items on the scale and then the customer is able to pay for the items. These SCOs are meant for customers with shopping baskets as shopping carts with large number of items would be laborious to check out using this system. Typically there are five self-checkout points supervised by one employee. Similar checkout concept is used in Ikea department stores.

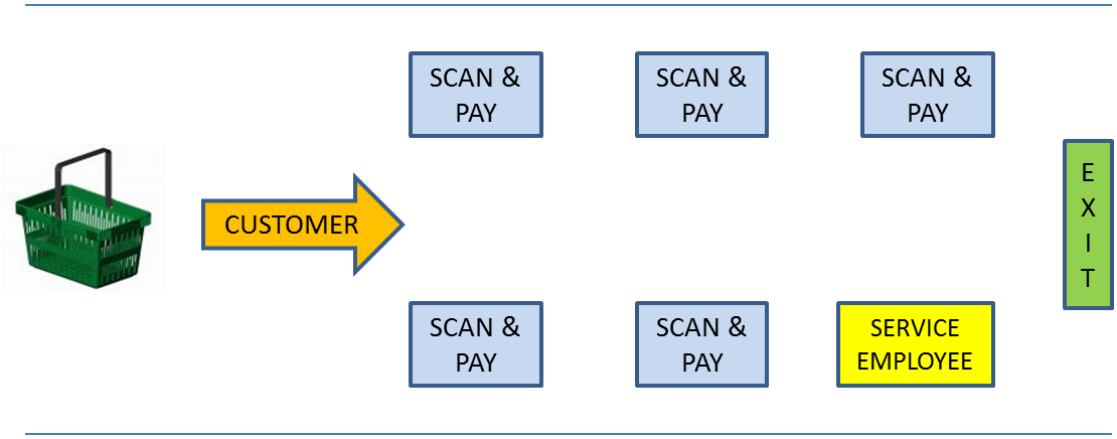

Figure 1: SCO solution used in Sites 1 and 2

Site 3 has a more comprehensive approach, as this large hypermarket store offers customers similar scan-and-pay tills as the kiosk solution in Sites 1 and 2 but also an option to use a shopping cart with a scanner attached (see illustration in Figure 2). When entering the store, a customer can take this cart scanner using the chain's loyalty card and start scanning the items as he or she places them in the cart. Current balance of the items can be seen on the scanner screen, so the customer has the exact information of how much the groceries are going to cost. When the customer enters the checkout area, he or she places the scanner into a reader and then pays for the groceries.

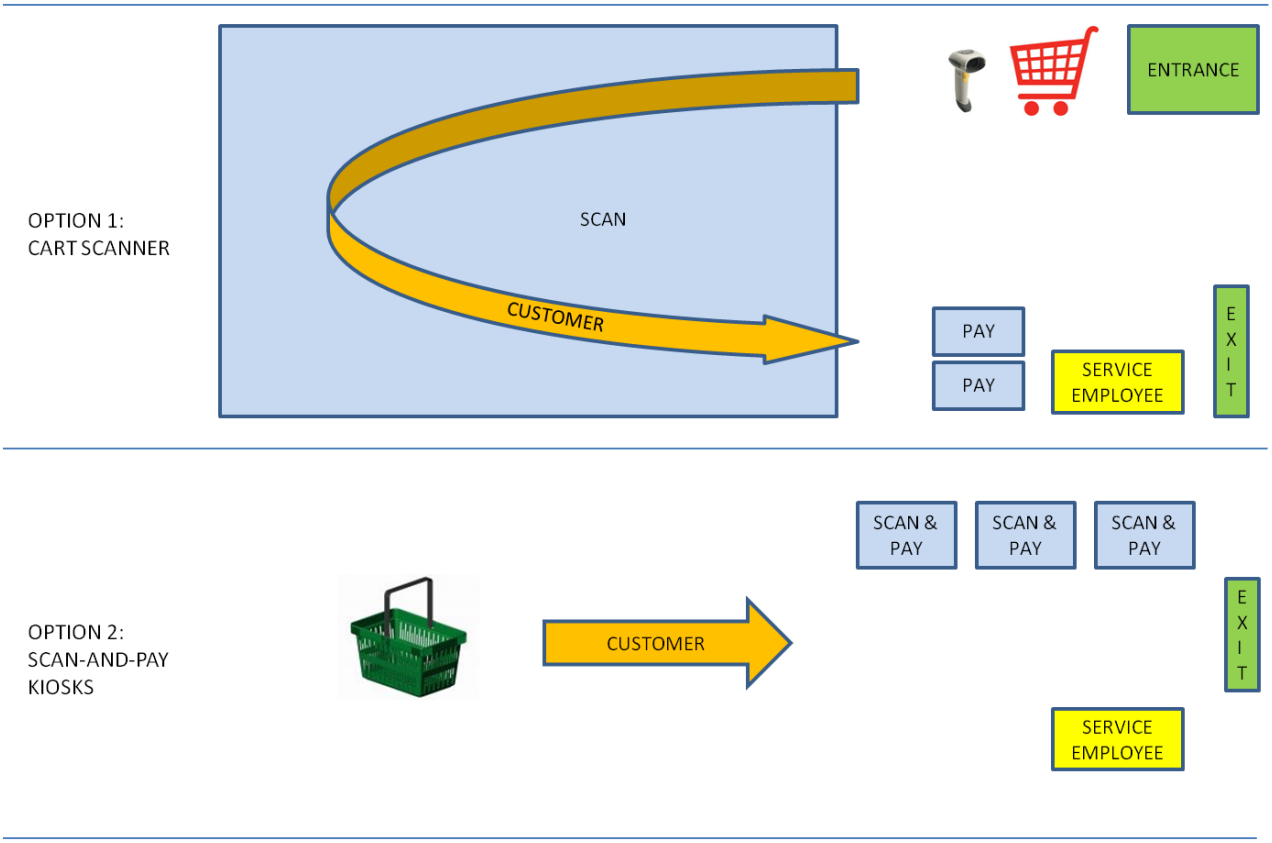

Figure 2: SCO solution used in Site 3

Unlike in most other countries, both SCO solutions used in Finland accept only debit or credit cards as a method of payment. Most likely the declining use of cash has supported the decision to invest in devices that don't have the cash payment option.

1.6. Structure of the thesis

This study is structured as follows. Chapter 1 presented an overview of the study by providing background information and explaining the motivation and scope of the study, along with identifying research gaps and stating the research objectives. The emergence of SCOs in Finland's retail environment was explained and the current SCO solutions illustrated. Chapter 2 builds a theoretical foundation for the study by defining terminology and introducing some relevant behavioral theories and research on the acceptance SSTs. In chapter 3, research hypotheses are stated and justified, and the research model and research instrument chosen for

the study are presented. Chapter 4 explains the methodology of the study and makes an overview on structural equation modeling techniques. Chapter 5 presents the data collection, sample, data analysis, and results. Chapter 6 includes conclusions drawn from the results, theoretical and managerial implications, and discussion of limitations and suggestions for further research. The two consumer surveys composed for this research are included in Appendix A and B.

2. LITERATURE REVIEW

This chapter provides a review of technology adoption literature relevant to the present study. The literature on technology adoption encompasses some essential models that have become useful in determining technology acceptance and usage. Information system science researchers have long tried to determine the factors that influence the adoption of an information system. The research has provided some essential information for the scientific community, and for organizations who typically want to maximize the utilization of a system in order to gain value for their investment.

First, some relevant terminology is explained. Then the theoretical foundations are laid by introducing some of the most influential behavioral theories. These models include the Theory of Reasoned Action (TRA), the Theory of Planned Behavior (TPB), the Technology Acceptance Model (TAM) and its extensions (TAM 2 & 3), and the Unified Theory of Acceptance and Use of Technology (UTAUT). After introducing the above mentioned theories, the research on the application of those models in SST adaptation context will be discussed. An overview to studies investigating the factors that influence intention to use and actual use of SSTs will be made, and their main findings will be presented.

2.1. Review of terminology

Before introducing the theories, it is in order to clarify some of the used terminology. The models presented in the next chapter (2.2.) are so-called structural models. This means that they consist of constructs that are related to each other in some ways. Constructs can be defined as abstractions that describe a phenomenon of theoretical interest (Edwards and Bagozzi, 2000, 156-157). Constructs describing a specified issue can be either observable (e.g. income,

temperature, time spent in a queue) or unobservable (e.g. customer satisfaction, anxiety, perceived utility), depending on the phenomenon they describe.

Constructs are evaluated by using measures that are referred to as indicators or items. Measures are observable and quantifiable scores that are obtained through empirical means such as a survey, interview, or observation (Edwards and Bagozzi, 2000, 156). Measures can be reflective or formative. Unobservable constructs, represent a phenomenon that cannot be measured with objective, quantifiable indicators such as temperature or profitability. Thus, they are measured with reflective indicators whose function is to express the nature of the construct. An unobservable construct consisting of reflective indicators is a reflective construct. Petter et al. (2007, 626) define reflective constructs to consist of indicators that are unidimensional and consistently reflect the construct. Constructs can be referred to as latent variables in statistics.

Moreover, according to Petter et al., any reflective individual measure can be removed to improve construct validity without affecting content validity. Hence, reflective indicators within a construct all measure basically the same phenomenon. A practical example of a reflective indicator could be a question in a survey measuring the customer satisfaction with a certain product. By using indicators that are very similar to each other (such as "I am satisfied with product X" and "Product X was a worthwhile purchase"), it is ensured that the construct describes the desired phenomenon accordingly. As the question must be answered using a certain numerical scale, such as five- or seven-point Likert scale, an unobservable phenomenon is being transformed into an observable and quantifiable one. Formative (or causal) measures do not consider internal consistency or reliability as they are measuring different aspects of the construct (Petter et al. 2007, 626). Unlike with reflective indicators, removing a formative indicator changes the phenomenon the construct is describing.

2.2. Relevant behavioral theories

2.2.1. Theory of Reasoned Action

The Theory of Reasoned Action (TRA, Figure 3) was originally developed by Fishbein and Ajzen (1975) to explain volitional behavior of an individual. They proposed that an individual forms a behavioral intention which leads to actual behavior. Moreover, behavioral intention is determined by individual's attitude toward the behavior and a subjective norm. Attitude toward

the behavior is defined as individual's emotion toward the behavior and is based on the perception about positive or negative consequences caused by the behavior. Subjective norm describes individual's perception of how people important to the individual consider one should behave in a given context, that is to say, the social pressure put on an individual (Ajzen, 1985).

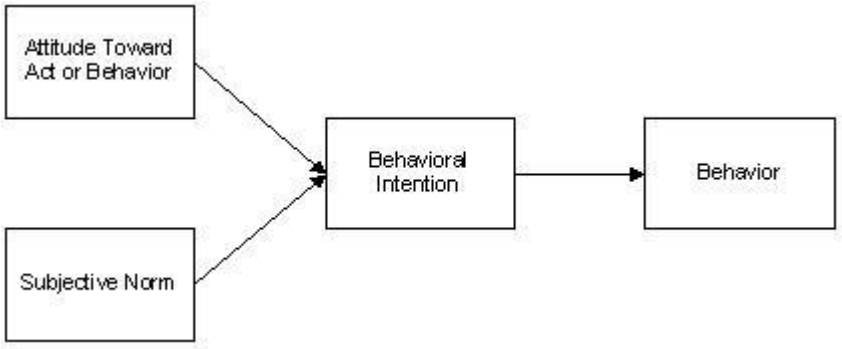

Figure 3: The Theory of Reasoned Action (Ajzen, 1975)

The TRA has proven its usefulness as it has been successfully applied in studies in various fields, from knowledge management to medical and psychological sciences. The theory is considered to be one of the cornerstones in the human behavior research, and it was later on applied by Davis (1989) in his influential Technology Acceptance Model. The TRA also laid a basis for another essential behavioral theory, the Theory of Planned Behavior.

2.2.2. Theory of Planned Behavior

Ajzen (1985; 1991, Figure 4) extended the TRA by including an additional construct in to the initial model, perceived behavioral control. This conceptual model, called the Theory of Planned Behavior (TPB), proposed perceived behavioral control to be a determinant of both behavioral intention and behavior. Perceived behavioral control is defined as the resources and opportunities available to a person to complete a task, and it can be also referred to as perceived self-efficacy (Ajzen, 1991). The TPB can be applied in various fields of science when trying to explain and predict human behavior. Some also consider it to be more suitable for IS adoption research than the TRA, as the lack of control or self-efficacy seems to be one major barrier in the adoption of technological solutions as less technologically oriented individuals may find them too complex to embrace.

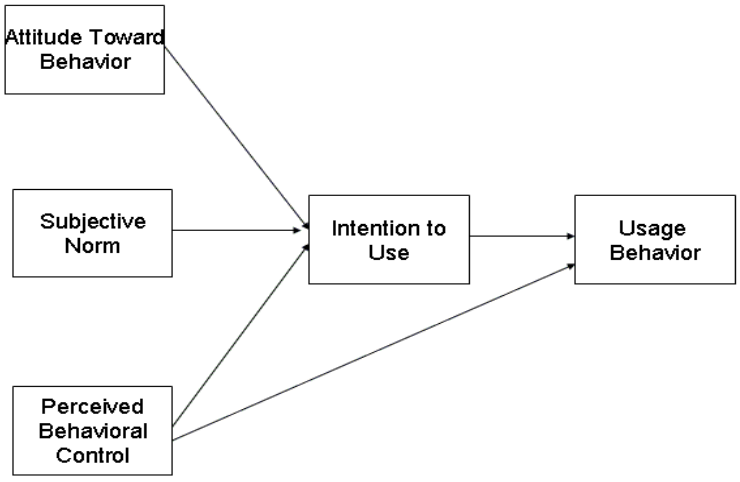

Figure 4: The Theory of Planned Behavior (Ajzen, 1985)

2.2.3. Technology Acceptance Model

Davis (1989) developed the Technology Acceptance Model for explaining behavioral intention and usage behavior of technology. The model was based on the TRA but it was attribute-based and excluded the subjective norm construct. As illustrated in Figure 5, the TAM extended the TRA model with two constructs that, based on earlier research, were expected to influence system use specifically in the IT context. The two main constructs, perceived usefulness and perceived ease of use were proposed to directly influence behavioral intention to use, which furthermore was proposed to be a direct determinant of actual system use. Perceived ease of use was also considered to directly determine perceived usefulness.

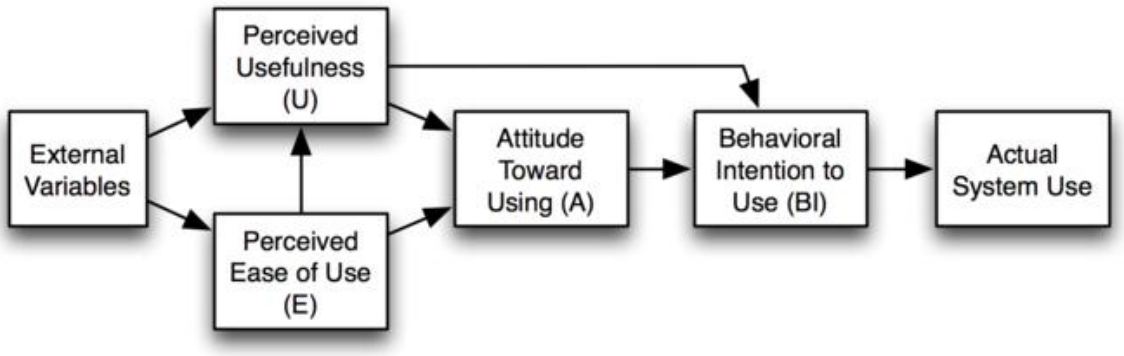

Figure 5: The Technology Acceptance Model (Davis, 1989)

Davis (1989, 320) defines perceived usefulness as "the degree to which a person believes that using a particular system would enhance his or her job performance." Thus, perceived usefulness of a system measures the possible advantages and improvements in performance that the system is expected to produce. Moreover, perceived ease of use is defined as "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989, 320). The model proposes that lesser perceived effort required to use the system leads to higher perceived usefulness and stronger intention to use the system.

Davis tested the reliability and validity of his model by conducting two studies, a field study among IBM office workers and a lab study among MBA students at Boston University. The data for measuring the model was collected by having the participants fill out a survey that contained questions about their perceptions of certain computer applications that were relatively new to the respondents. The main constructs, perceived usefulness and ease of use were measured using multiple items and their relationships with intention to use and actual use were investigated by running regression analyses. Intention to use was found to be significantly correlated with actual use. Moreover, perceived usefulness and ease of use were observed to be direct determinants of usage, the former one being significantly stronger than the latter.

Davis et al. (1989) examined the TAM model by conducting a longitudinal study to measure intention to use a computer system and comparing the TAM model's performance to the TRA model. The main finding of the study was that perceived usefulness and perceived ease of use

had a direct effect on behavioral intention, making the attitude toward behavior construct of the initial model redundant. Furthermore, later in 1996 Venkatesh and Davis introduced the so-called final version of the TAM (Figure 6), where the attitude construct was eliminated.

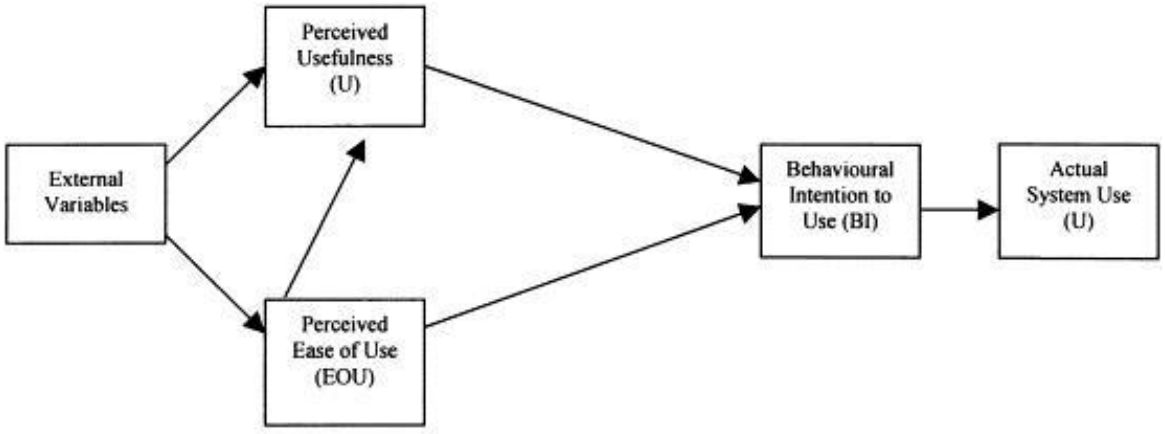

Figure 6: The Technology Acceptance Model (Venkatesh and Davis, 1996)

Since its introduction, the Technology Acceptance Model has become one of the most utilized frameworks for predicting and understanding technology adoption. Compared to alternative models, such as the TRA and the TPB, the TAM has been able to better explain the variance in use intention and behavior with a typical proportion of 40 % (Venkatesh & Davis, 2000, 186). In addition, being an attribute-based model, TAM's generalizability is better than that of the above mentioned models (Martin, 2012, 35). Wide emergence of information communications technology has most likely further promoted the relevance of the model. Extensive empirical research supports strongly the presumption that perceived usefulness and ease of use directly explain behavioral intention to use a technology and that perceived ease of use determines the perceived usefulness (Venkatesh & Davis, 2000, 187). Thus, the TAM has been a reigning research model in the technology acceptance literature and has been used in numerous studies for the last two decades. However, despite the wide empirical support, the TAM does have some major limitations that will be briefly discussed next.

Chuttur (2009) proposes three categories of criticism of the TAM model: the methodology used for testing the TAM model, the variables and relationships that exist within the TAM model, and

the core theoretical foundation underlying the TAM model. TAM studies typically use self-reported use data to measure system use instead of real actual use data. Some researchers consider that this makes the conclusions unreliable, as self-reported use data is a subjective measure. The relationships between the traditional TAM variables are not always confirmed, especially in mandatory settings. Also in some settings, external factors like system experience, education, and age may have greater direct effect on system usage than the TAM variables. Bagozzi (2007) has questioned the fundaments of the TAM by criticizing it to be too simple and leaving out important variables. He claims that system usage should not be seen as a terminal goal but as a means to a more fundamental goal. Bagozzi also stated his doubts about intention to use leading to actual system use. Many other factors than intention may determine individual's technology usage and the link between the two is full of uncertainties. On the other hand, the TAM has later been extended into increasingly complicated models that aim to consider every relevant aspect of the technology acceptance. Some of these TAM extensions will be discussed next.

2.2.4. TAM 2 and TAM 3

Later in 2000, Venkatesh and Davis extended the original TAM into a new theoretical framework referred to as the Technology Acceptance Model 2 (TAM 2). The core TAM model (1996) was left untouched and external constructs were brought in to explain behavioral intention through perceived usefulness. Social influence constructs were voluntariness, image, and subjective norm; the latter was brought to the model from the original TRA. Subjective norm was found to have a direct effect on intention to use, over and above both perceived usefulness and ease of use. Also cognitive instrumental processes (job relevance, output quality, result demonstrability, perceived ease of use) had a significant impact on technology acceptance. See TAM 2 in Figure 7.

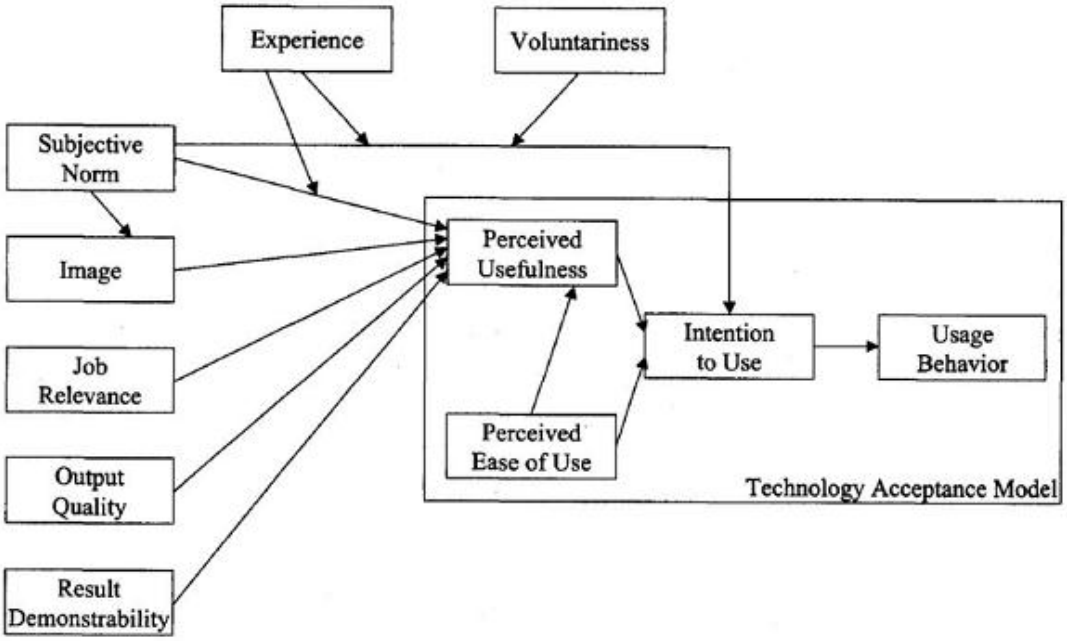

Figure 7: The Technology Acceptance Model 2 (Venkatesh and Davis, 2000)

The model was meant to be applicable in a context where a new information system is introduced at a workplace, so constructs were developed accordingly.

In 2008, Venkatesh and Bala developed the TAM core model even further by introducing the Technology Acceptance Model 3 (TAM 3). The new model (Figure 8) clearly surpassed its predecessors in complexity, as it combined TAM 2 with Venkatesh's (2000) earlier model of the determinants of perceived ease of use. Thus, six new additional constructs from Venkatesh's (2000) model were added to the TAM 2 and new relationships between initial constructs were established. The determinants of perceived ease of use were divided into anchoring and adjustment constructs.

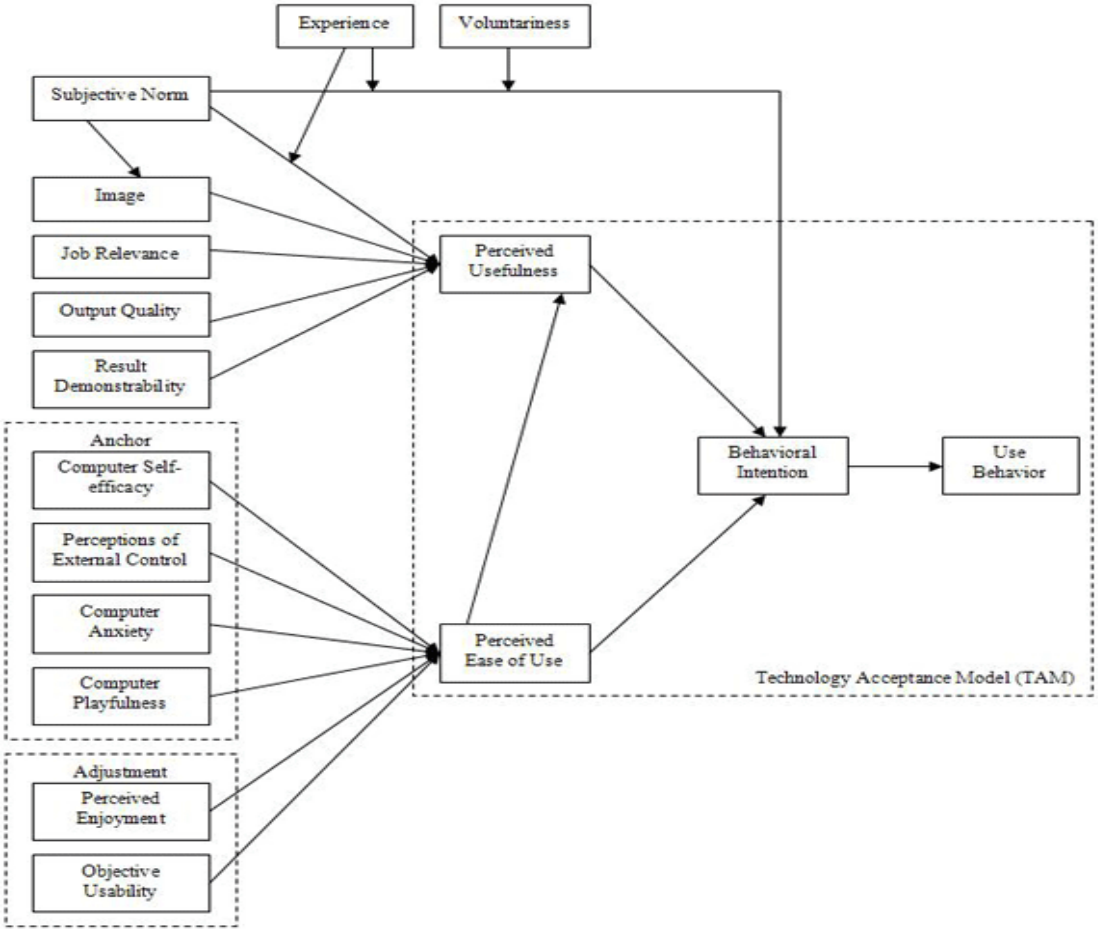

Figure 8: The Technology Acceptance Model 3 (Venkatesh and Bala, 2008)

2.2.5. Unified Theory of Acceptance and Use of Technology

Venkatesh et al. (2003) constructed an ambitious technology acceptance model by combining constructs from earlier theories, including the TRA, the TPB, several variations of the TAM and some other models, into one single Unified Theory of Acceptance and Use of Technology (UTAUT) model (Figure 9). Seven significant constructs were identified from eight initial technology acceptance models and four of these constructs were identified as direct determinants of behavioral intention to use a technology or the actual usage behavior. Performance expectancy (PE), effort expectancy (EE) and social influence (SI) were found to be direct determinants of behavioral intention. Furthermore, facilitating conditions (FC) and behavioral intention were discovered to directly determine the use behavior. Each of the main constructs was operationalized by using items adopted from the eight initial models. Four antecedent

characteristics were selected as moderating factors for these determinants. Factors chosen were gender, age, experience and voluntariness of use, where experience relates to individual's previous experience of using the system and voluntariness to the degree of which the use of the system is voluntary or mandatory.

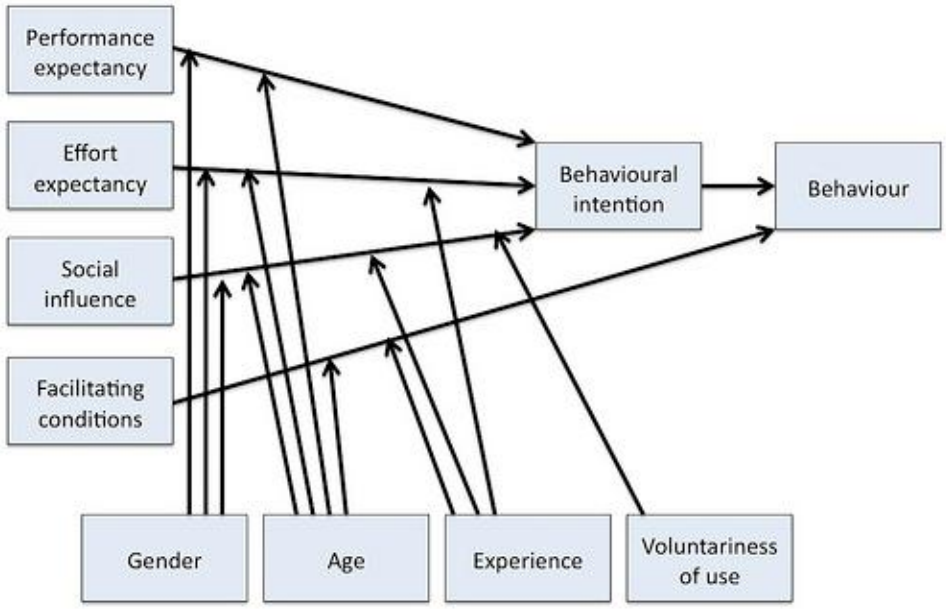

Figure 9: The Unified Theory of Acceptance and Use of Technology (Venkatesh et al., 2003)

When building their model, Venkatesh et al. (2003) left out some constructs that are very generally used in many other models in this field of research. Those were computer self-efficacy, computer anxiety, and attitude towards technology, as the researchers found that computer self-efficacy and anxiety did not have a direct effect on behavioral intention, when effort expectancy was included in the model. Moreover, Venkatesh et al. (2003) observed that the effect of attitude towards technology stems from other key predictors of behavioral intention, especially from performance and effort expectancies.

As the eight individual models were able to explain 17-53 % of the variance in user intentions to use information technology, the new combined model outperformed them by explaining 70 % of the variance. The UTAUT model and its extensions have been applied in the research of several different types of SSTs, such as convenience store kiosks (Chiu et al., 2010), mobile banking

(Yu, 2012), mobile shopping services (Yang, 2010), and workplace computer systems (Keeton, 2008; Venkatesh and Zhang, 2010).

2.3. Research on SST acceptance

Determinants of intention to use self-service technologies have been widely investigated during the past two decades. Researchers have studied the influence of demographic factors such as age, gender, education, and income on SST acceptance. Typically, several psychographic factors have been included as well, such as need for interaction, technology anxiety, and self-efficacy. These intrinsic variables have been commonly used either as controls or moderators for the effects of extrinsic variables related to individual perceptions of the technology in question. Extrinsic variables have usually been adopted from the theories discussed in the previous chapter, the TAM (Davis, 1989; Venkatesh and Davis, 1996) being probably the most popular basis for a research model. Most of the research investigates the determinants of attitude toward SST or intention to use SST and the interrelationships between those determinants. Some have also further examined the determinants of actual use of SSTs (e.g. Weijters et al, 2007; Juntumaa & Öörni, 2011). In addition, a number of studies address the effect of case-specific situational factors, such as crowding and waiting time (e.g. Dabholkar & Bagozzi, 2002; Weijters et al. 2007; Simon and Usunier, 2007; Martin, 2012).

First, some literature investigating the determinants of SST adoption will be discussed. Second, an overview of studies using TAM-based framework for studying intention to use SSTs will be provided. This is followed by a review of studies that include an investigation of the determinants of actual SST use. The main focus will be on studies discussing adoption of self-service checkout technology in a retail store setting but also several studies concentrated on other forms SST, such as mobile banking and e-invoicing, are presented. The studies will be discussed in chronological order and are mainly structured by first describing the applied research model and used methodology, and then discussing the main findings.

2.3.1. Literature on the determinants of SST adoption

Dabholkar et al. (2003) have investigated the reasons for both using and avoiding self-service checkouts. The study based itself on conceptual framework explaining attitude toward and use of

SCOs. The sample of their field study consisted of 101 consumers who were currently shopping in a retail store. The findings suggested that the key determinants of SCO use were speed, ease of use, control, reliability and enjoyment. High need for interaction with service employees seemed to have a strong negative effect on SCO usage. Consistently, some consumers not so fond of personal contact even intended to use SCO option just to avoid interaction with employees.

Meuter et al. (2003) have studied the influence of technology anxiety on consumer use of and satisfaction with SSTs in retail environment by collecting a sample of 823 survey responses. They found that technology anxiety has a negative effect on actual SST use and is a better predictor of SST use than demographic factors. Technology anxiety also influenced the overall satisfaction with SST and intention to use the SST again.

The effects of personal thinking styles on preference for SST option have been examined by Simon and Usunier (2007). In addition, they included age, perceived service complexity, and waiting time as potential determinants of SST preference. The study was based on face-to-face interviews conducted with 115 consumers. Responses were measured using a structural model and the data was analyzed in Mplus. Researchers found that rational engagement had a positive effect on the preference of SSTs, and subjects with high experiential style were keener with personal service. However, the effect of personal thinking styles was strong with complex SSTs but diminished with simpler SSTs. Age was negatively correlated with the preference of SSTs.

Dean (2008) has investigated the effect of shopper age on attitudes toward retail SST and its usage as he considered that the age variable had received insufficient attention in the literature. His findings showed that older consumers had more negative attitudes in general toward SST and were less likely to use SST option, compared to younger consumers. From the total sample of 718 consumers, as much as 40 % reported choosing the SCO option 15 % of the time or less. The study was executed in New Mexico and was based on questionnaires filled out by 718 respondents.

Lee et al. (2010) have explored the relationships between consumer demographic factors (gender, age, education and income) and consumer traits (technology anxiety, need for interaction, technology innovativeness), and how they influence consumer's intention to use retail self-service checkouts. They discovered that individual differences in the intention to use

SCOs stem from consumer traits, and demographic factors only indirectly influence the intention through those traits. Technology innovativeness was found to promote intention to use, whereas technology anxiety and need for interaction had a negative impact on the intention.

Schliewe and Pezoldt (2010) made a cross-cultural comparison how Germans and Russians differ in retail SCO acceptance. The researchers compared the extent of how the following psychographic factors influence intention to use SCOs: social pressure, self-efficacy, and technology anxiety. The data was collected from 267 university students from Germany and Russia. German students were observed to have lower levels of social pressure and technology anxiety, and higher self-efficacy than Russian students. The results suggest that the customers in different kind of countries (e.g. Eastern vs. Western) should be addressed in different ways when implementing SCOs.

2.3.2. TAM-based literature on the determinants of intention to use SSTs

Dabholkar and Bagozzi (2002) used an attitudinal model derived from the original TAM, adapted from Dabholkar's earlier study from 1994, to determine where the intention to use self-service touchscreen ordering in a restaurant stems from. Ease of use, performance, and fun were considered as the core determinants of attitude toward using touchscreens and were moderated by consumer traits such as self-efficacy, inherent novelty seeking, need for interaction, and self-consciousness. Attitude toward self-service technology was expected to be a direct determinant of intention to use, and situational factors perceived waiting time and social anxiety were brought in as moderating variables. Research was executed by conducting a survey among 392 college students. Both situational factors were found to strengthen positively the relationships between both ease of use and attitude, and fun and attitude. In addition, greater perceived waiting time attenuated the relationship between performance and attitude.

Phongkusolchit (2007) has studied the impacts of technology anxiety, need for interaction with service employees and expected service quality on intention to use self-service checkout option in a retail store. He constructed a structural model based on theoretical background of the TRA, TAM, and TPB, where technology anxiety and need for interaction with service employees were expected to be negative determinants on intention to use SST and expected service quality to be its positive determinant. Moreover, need for interaction with service employees was expected to

have a negative impact on expected service quality of the SST option. Data for the study was collected from 653 students by distributing a paper-based survey. Consistently with Dabholkar et al. (2003), Phongkusolchit found need for interaction with service employees to have a significant negative influence on expected service quality. Also the hypothesized effects of expected service quality and need for interaction with service employees on use intention were confirmed. However, technology anxiety had no statistically significant negative effect on intention to use SST.

Chiu et al. (2010) have applied the UTAUT model to study the differences between early and potential adopters in intention to use self-service kiosks. The researchers constructed a modified UTAUT model, limiting out demographic factors and bringing in technology readiness trait as a factor that was expected to moderate the four original UTAUT constructs; performance expectancy, effort expectancy, social influence, and facilitating conditions. Consistently with Venkatesh (2003), all the above mentioned constructs did significantly influence the behavioral intention to use the system. Compared to potential adopters, early adopters were observed to have higher levels of PE and EE, and were more strongly influenced by SI and FC. However, the moderating effect of technology readiness remained unclear, possibly due to high level of technology readiness among the sample. Lin and Hsieh (2006), on the other hand, have found that high level of technology readiness does lead to favorable use intention of self-service technology in general, as they included all the forms of SST, such as ATMs and internet banking.

Gender differences are the focus of a study by Lee et al. (2011), where they investigated gender differences in the four dimensions of perceived service quality of retail self-service kiosks. The four dimensions were time convenience, ease of use, control, and enjoyment. Service quality was expected to be moderated by technology anxiety and need for interaction, and high perceived service quality was expected to lead to increased actual use of SST. The model was based on the TAM (Davis, 1989) and on Dabholkar's earlier adoption models. Sample was drawn from USA-based consumer panels and 300 completed surveys were used for analysis. No difference in the effect technology anxiety was observed between men and women but women expressed a stronger need for personal interaction, which influenced the experienced service quality.

However, the findings indicated that the relationship between perceived service quality and actual use of SST was not moderated by gender.

Cho (2011) has contributed the research field by introducing a conceptual model that explains intention to use SSTs in apparel retail setting through attitude toward SST which is determined by intrinsic and extrinsic motivation factors and moderated by familiarity toward SSTs. Intrinsic motivation factors were perceived enjoyment and technology anxiety. The former one had a positive relationship with attitude toward SST, the latter one negative. Both extrinsic factors, perceived usefulness and perceived time saving, had a positive impact on the attitude toward SST. Consistently with the initial TAM study by Davis (1989) and numerous other studies, attitude toward SST was confirmed as a direct determinant of intention to use SST.

A recent study by Martin (2012) follows Dabholkar & Bagozzi (2002) by investigating how situational factors, customer demographic traits, and technology readiness moderate perceived usefulness and perceived ease of use of a self-scanning system in a retail hardware store. The traditional TAM relationships were used as a basis for the extended model, where situational factors, wait time and crowding, were added. Wait time described the degree of self-service option causing a longer waiting time for the customer compared to regular checkout. Similarly, crowding described the level anxiousness of using self-checkout, caused by other consumers lining up behind one. The results suggested that crowding had a negative impact on perceived usefulness, perceived ease of use and behavioral intention. Similarly, also a long waiting time decreased the perceived usefulness and behavioral intention but logically did not appear to have a significant relationship with perceived ease of use. As Dean's (2008) study implied, also here younger consumers had more favorable attitudes toward SCOs compared to older ones and had a stronger intention to use them. Interestingly, the results did not confirm perceived ease of use to be a direct determinant of perceived usefulness nor behavioral intention. Contradictory to majority of research, Martin's (2012) study did not support the significance of the traditional TAM relationships.

2.3.3. Determinants of actual SST use

As stated previously, the vast majority of TAM related literature is limited to the determinants of behavioral intention to use a system and do not consider the practical effect of intention and

other factors on the actual system use. A common assumption is that individuals choose to use the superior alternative technological solution toward to which they have a high use intention (Juntumaa & Öörni, 2011). However, the relationship between intention and actual use is not necessarily always as straightforward as might be assumed. Only few empirical studies have investigated the link between intention to use SST and actual use in real-life setting (Weijters et al. 2007).

Meuter et al. (2005) argue that trying a self-service technology for the first time is an essential step toward repeated use and commitment to the usage of the technology. However, the key barrier in the technology adoption seems to be the difficulty of getting consumers to trial the new technology. Using a framework consisting of consumer innovation characteristics and individual differences that define consumer readiness, the researchers recognized key factors that influence the initial SST trial decision. Two studies were conducted, first one investigated the consumer trial of IVR telephone-based SST, and the second one the trial of an Internet prescription refill ordering system. Their findings suggest that consumer readiness variables of role clarity, extrinsic and intrinsic motivation, and ability mediate the antecedent individual predictors of consumer trial and the actual trial.

A study by Weijters et al. (2007) takes an exceptionally comprehensive approach for studying consumers' attitudes and behavior in a real-life grocery retail store setting. Besides of examining the determinants of behavioral intention, the study also dealt with the relationship between use intention and actual use of SST. Moreover, they studied how SST use and perceived waiting time and actual time spent in the store finally affect customer satisfaction, and how the number of items purchased and the number of customers in the checkout lane, influence these relationships. The research team used a model derived from the traditional TAM but considerably extended and altered. Perceived usefulness, perceived ease of use, reliability, perceived fun, and newness were constructs hypothesized to be direct determinants of attitude toward SST which was further expected to be a direct determinant of SST use. Demographic factors age, gender, and income were expected to moderate these relationships. The study was executed as a field research by having six teams to collect data in six grocery stores. Data was collected in two stages, by asking consumers to fill out a first questionnaire when entering the store and a second one when exiting.

This is a solid way to confirm the link between attitude and behavior, although one might argue that the setting could lead respondents to behave in a certain way.

Weijters et al. found that all the determinants had the hypothesized positive effect on attitude toward SST, and the link between attitude and SST use was confirmed. However, newness construct had a negative effect to attitude among respondents with low education level but a positive effect among the highly educated. There was no difference between SST users and non-SST users in actual time spent in store, regardless of how many products they bought. Perceived waiting time for non-SST users increased as the number of products increased but his was not the case with SST users. Logically, perceived waiting time had a negative effect on customer satisfaction. Moreover, the negative effect was stronger for SST users than non-SST users, which might be due to higher expectations that SST users presumably have toward waiting time compared to non-SST users.

Technology acceptance models have been applied for studying the adoption of mobile banking, i.e. by Sripalawat et al. (2011) and Yu (2012). Sripalawat et al. (2011) studied the acceptance of mobile banking in different countries by combining the effects of positive and negative factors that are expected to determine the acceptance of this SST. The researchers used a heavily extended TAM as a research model as they brought in some technology-specific constructs such as device barrier, perceived risk and perceived financial cost. Key factors of m-banking adoption in every country included in the study were found to be perceived usefulness (as a positive factor) and lack of information (as a negative factor). The effects of other factors varied depending on the country. Yu (2012) investigated the same topic through the UTAUT framework. Similarly with Sripalawat et al., the model was extended to better explain the mobile banking adoption. Use intention and facilitating conditions were found to strongly determine the usage behavior, and gender and age had significant moderating effects.

Juntumaa & Öörni (2011) have studied the adoption of e-invoicing, and they discovered that a positive attitude toward the adoption and a high intention to adopt may not be sufficient drivers of full adoption. The study was conducted as an empirical investigation by collecting consumer data through a web questionnaire, yielding a sample size of 303 respondents. The findings showed that even though a new technological solution was considered superior to the present

alternative (paper invoicing in this case), it lead only to a partial adoption of this solution. Thus, further research for confirming the link between intention to use and actual use is called for in different research contexts and settings.

2.3.4. Other relevant SST literature

Meuter et al. (2000) have investigated the sources of satisfaction or dissatisfaction with SSTs by conducting an online survey with open-ended questions. By analyzing the qualitative data collected from 823 respondents, they found three sources of customer satisfaction: SST solving an intensified need, SST being better than the alternative, and SST "doing its job". The major factor groups for dissatisfaction were SST's technology failure, process failure, poor design, and customer-driven failure. Altogether 44 % of the sample reported having had dissatisfactory encounters with SSTs.

For deeper understanding of why consumers accept or reject SCO solutions, Opara-Nadi (2005) has compared the performance and use of traditional cashier checkouts and electronic SCOs in Wal Marts in Mississippi. He studied the mean number of items checked out by the two systems, average time spent on checkout process, the error rates, and the affection and confidence of customers and managers toward the two systems. Findings showed that the average checkout process was faster and the error rates smaller at the cashier checkouts. This was believed to result partly from customers' unfamiliarity with the SCO technology.

Reinders et al. (2008) have studied the effects of forcing customers to use SST by offering no other option for service delivery. The study was conducted within railway ticketing context. They found that forced use will promote negative attitudes and use intentions toward the SST. Similarly, White et al. (2012) found that retailers "pushing" customers to adopt SST is likely to lead to decreased commitment to the retailer, if the pushing policy is considered unfair by the customer.

3. RESEARCH MODEL

The research framework used in this study was constructed on the theoretical foundations discussed in the previous chapter, using the TAM as a basis and extending it with constructs

relevant to the present study. The TAM was considered the most suitable foundation for the study, as it is a robust, attribute-based model, and enjoys wide empirical support. While in some research settings the more advanced and complex models such as TAM 3 and UTAUT have been able to explain the variance of technology adoption better than the simpler models, their generalizability is limited due to their complexity and case-specificity. Thus, a conceptual model based on the core TAM relationships has been constructed for the research purposes of this study. The core TAM has been extended to fit better into the present SCO context. Next, the main constructs of the model will be presented and research hypotheses stated.

3.1. Hypothesis development

This subchapter presents the constructs chosen for this study and states the research hypotheses. The choosing of the constructs and the development of hypotheses are justified by drawing from findings of earlier work on SST acceptance. After the presentation of constructs and development of hypotheses, control variables used in the study will be introduced and their relevance explained.

3.1.1. Research constructs

Perceived usefulness

Drawing on the extensive research on TAM and studies conducted on the adoption of SCOs, the core TAM relationships are expected to hold. According to Venkatesh and Davis (2000, 187), perceived usefulness has been confirmed as a strong determinant of user acceptance in the TAM literature. SCO is primarily a utilitarian system, made to facilitate the checkout process, so the significance of usefulness is easily justified in the present research context.

Dabholkar and Bagozzi (2002, 186), on the other hand, suggest that the perceived usefulness determinant is not relevant for the kind of SST that customer does not own but only participates (such as SCO). Instead, they used a performance construct in their study to represent the perceived reliability and accuracy of the SST. However, in the present study perceived usefulness construct is applied to describe both the usefulness and the performance, as they are considered to measure the same thing in this context. According to Childers et al. (2001), "in the utilitarian view, consumers are concerned with purchasing products in an efficient and timely

manner to achieve their goals with a minimum of irritation." Moreover, also here the primary objective of a grocery shopper is assumed to be clearing through the checkout process as swiftly and efficiently as possible. The usefulness construct is composed to describe this objective. Thus, it is suggested here that SCO being primarily a utilitarian system, greater perceived usefulness will lead to a stronger intention to use the system.

Hypothesis 1: Perceived usefulness of SCOs is positively related to intention to use SCOs.

Cash payment option

One dimension of perceived usefulness of SCOs is the method of payment the checkout system supports. Currently, SCOs used in Finland accept only payment cards. Although cash usage in Finland is steadily declining, cash still remains a significant tender. If one prefers to always use cash when buying groceries, the lack of a cash payment option might make SCOs useless to him or her; no matter how much more efficient the technology would be otherwise. As the SCOs in Finland don't have a cash payment option, it is justified to presume that the lack of this option may affect the perceived usefulness of the system for some consumers. Furthermore, the people who prefer cash may not even intend to use the SCO system since it does not enable cash payments. Thus, an additional case-specific construct is introduced here, and the following hypothesis is stated:

Hypothesis 2: Preference of cash payment option in SCOs is negatively related to perceived usefulness of SCOs and intention to use SCOs.

Perceived ease of use

Another core TAM construct, perceived ease of use, is especially relevant for the present study. The past research on TAM suggests it to be the strongest predictor of use intention of SCOs right after perceived usefulness. The significance of perceived ease of use has been proven in research on IT adoption in organizational context (Davis et al., 1989; Venkatesh et al., 2003) as well as in research on retail SSTs (Weijters et al., 2007; Chiu et al., 2010; Lee et al., 2011).

SCOs are meant for the use of all grocery store customers, regardless of how familiar they are with technology. Therefore, the perceived effort that using SCOs requires, can have a tremendous impact on the use intention of SCOs. Here, perceived ease of use is defined

according to Davis (1989): "the degree to which a person believes that using a particular system would be free of effort". Perceived ease of use is considered as a key independent variable determining use intention of SCOs. Thus, the following hypothesis is proposed:

Hypothesis 3: Perceived ease of use of SCOs is positively related to intention to use SCOs.

Moreover, Venkatesh and Davis (2000, 343) argue that the easier the system is to use, the more useful it can be. From two otherwise equal systems, a customer is likely to find more useful the one that he or she perceives to be easier to use. Since usefulness of SCO can be considered largely based on how much it speeds up the checkout process, it is logical to assume that the easier the system is to use, the faster the checkout process can be completed. Thus, drawing from the earlier TAM research, perceived ease of use is hypothesized to be a direct determinant of perceived usefulness:

Hypothesis 4: Perceived ease of use of SCOs is positively related to perceived usefulness of SCOs.

Perceived enjoyment

Venkatesh (2000, 351) defines perceived enjoyment as the extent to which "the activity of using a specific system is perceived to be enjoyable in its own right, aside from any performance consequences resulting from system use." He brought perceived enjoyment construct into his extended TAM model as a determinant of perceived ease of use (Venkatesh, 2000). As perceived usefulness and perceived ease of use represent the utilitarian aspect of SCO usage, several other studies have introduced a hedonic variable such as perceived enjoyment or perceived fun as a determinant of ease of use, attitude towards SST, and/or intention to use SST (Weijters et al., 2007; Cho, 2011).

Van der Heijden (2004) studied the use intention of hedonic information systems and found that with hedonic IT systems perceived enjoyment and perceived ease of use were stronger determinants of use intention than perceived usefulness. While SCO itself is quite clearly a utilitarian system, the shopping trip in general has a hedonic dimension and the checkout process is a part of this experience. Babin et al. (1994, 653) suggest that "consumer value is indicated in both utilitarian and hedonic terms". The proposed relationship between perceived enjoyment of

using SCOs and use intention is supported by the findings of Dabholkar et al. (2003), Weijters et al. (2007), Lee et al. (2011), and Uitto (2011). Based on these justifications, it is proposed that:

Hypothesis 5: Perceived enjoyment of SCOs is positively related to intention to use SCOs.

As suggested by Van der Heijden (2004), perceived ease of use is expected to be a direct determinant of perceived enjoyment. Also Venkatesh (2000) found, these two variables have a positive relationship. The present research model suggests that a user friendly interface is likely to be more fun and enjoyable to use:

Hypothesis 6: Perceived ease of use of SCOs is positively related to perceived enjoyment of SCOs.

Intention to use and actual use

Several studies have confirmed the positive relationship between intention to use or attitude toward an information system, and the actual usage of the system (e.g. Dabholkar et al., 2003; Venkatesh & Morris, 2000; Venkatesh et al., 2003). However, the extent of this relationship might be case- or technology-specific, as Juntumaa and Öörni (2011) discovered that behavioral intention to use e-invoicing did not lead to actual use of the technology in question. Moreover, Bagozzi (2007) has stated his doubts about intention leading to actual use. Therefore, further assessment of the subject is called for, as this issue has not been addressed much in the SST research field. Drawing from the extensive TAM literature, the relationship between intention to use SCOs and actual SCO use is expected to be as follows:

Hypothesis 7: Intention to use SCOs is positively related to the actual use of SCOs.

SCO use and customer satisfaction

The relationship between actual SCO use and customer satisfaction has received little attention in the research field, even though it may be one of the key factors in understanding SCO acceptance. Weijters et al. (2007) touched the issue by studying the effect of perceived waiting time on customer satisfaction between SCO users and non-users. Here, the question of interest is following: does usage of SCOs lead to improved customer satisfaction and are customers embracing SCO option because they feel it enhances the store's service or because they feel they

are forced to use it? Reinders et al. (2008) studied the consequences of forcing consumers to use SSTs, and they found that if consumers feel being forced to use an SST option, it will have an adverse effect on their behavioral intention. Forcing, or more appropriately encouraging consumers to use SCOs can be done e.g. by locating less service employees to traditional checkouts, as discussed by White et al. (2012).

As an SCO system is a high-cost, long-term investment, its effect on customer satisfaction needs to be studied. The practical importance of this topic is supported by the Satisfaction-Profit Chain proposed by Anderson and Mittal (2000), presented in Figure 10.

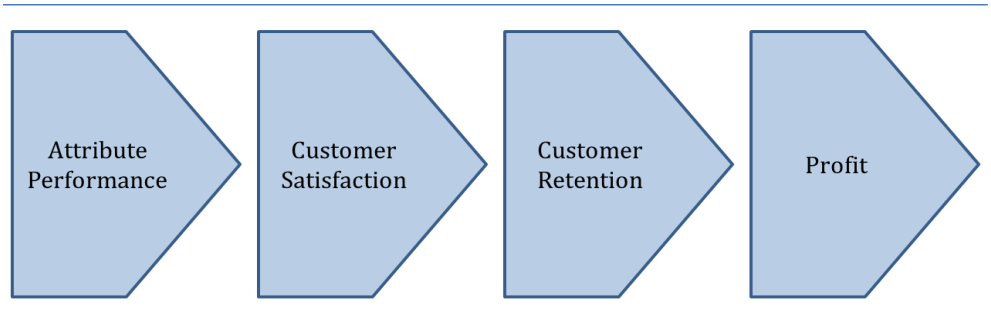

Figure 10: The Satisfaction-Profit Chain (Anderson and Mittal, 2000)

Furthermore, this study aims to investigate, whether SCOs are a source of customer satisfaction for those who use them or do customers use them but still feel that they reduce the service quality. Therefore, examining the relationship between SCO use and customer satisfaction related to SCOs is in order.

Hypothesis 8: SCO use is positively related to customer satisfaction in relation to SCOs.

Perceived waiting time

The effect of some context-specific situational factors on behavior has been investigated in the earlier SST research. The most relevant situational factor in the SCO context is probably waiting time or length of a queue. Martin (2012) found that perceptions of situational factors wait time and crowding are negatively related to perceived usefulness and use intention of SCOs. Moreover, according to Weijters et al. (2007), perceived waiting time has a significant effect on

customer satisfaction for those customers who use SCOs. However, the approach of the present study is to investigate the potential triggering effect perceived waiting time to SCO option may have on the actual use of SCOs. This triggering effect can cause a customer to behave differently than what his or her original intention was. For instance, a customer who has a very low intention to use SCO might choose to use it anyway, if he or she perceives that it shortens the waiting time or queuing time at the moment. Hence, perceptions of queuing and waiting time are expected to play a significant role in the adoption of retail SCOs.

As observing the actual waiting times to different checkout options was not possible in this study setting, consumers' perception of waiting time is used to measure the impact. This study applies the definition of perceived waiting time by Dabholkar and Bagozzi (2002, 189): "the consumer's perception of whether he or she will have to wait for a significantly longer time to use a particular service delivery option than to use an alternative option." In addition, this study will also address perceived waiting time as a direct determinant of actual SCO usage but the main focus will be on its moderating effect.

Hypothesis 9: Shorter perceived waiting time to SCO option amplifies the effect of behavioral intention to use SCOs to actual use of SCOs.

3.1.2. Control variables

In explanatory research, such as the present one, a common threat is that factors other than the ones of theoretical interest will influence the results and lead to invalid causal inferences (Atinc et al., 2012). To avoid this, the research must be designed so that the effects of these factors can be distinguished and eliminated, if necessary. Control is a central method for ruling out the possibility of undesired factors that may affect the validity of inferences. This can be done by including control variables, which can be based on e.g. demographic factors or basically any other kind of denominator that is expected to influence the variables under scrutiny.

Hence, to be able to make valid inferences from results, five control variables are included in this study. The most common control variables in SST research field have been based on demographic and psychographic factors. Their effect on the adoption of SCOs has been studied quite extensively but the results have been somewhat contradictory. According to Dabholkar and Bagozzi (2002), due to increased familiarity with technology among people in general,

demographic factors are no more relevant determinants of SST acceptance. On the other hand, a great deal of research has found demographics, such as age and gender, as significant determinants of technology acceptance. Atinc et al. (2012) stress the importance of empirical justifications for the inclusion of control variables. Thus, as certain factors are expected to play an essential role in retail SCO acceptance, their inclusion as control variables will be justified next by applying the findings of some previous studies to the present research context.

Age

The significance of age as a determinant of technology acceptance has produced contradictory findings in earlier research. While its strong effect on the SST acceptance has been confirmed in some studies (Dean, 2008; Martin, 2012), others have found age to have no significant influence at all (Dabholkar et al., 2003; Weijters et al., 2007). Simon and Usunier (2007), as well as Dean (2008) have found that older people have more negative attitudes toward SST systems than younger people. Venkatesh et al. (2003) suggest that the effect of performance expectancy on behavioral intention to use a technology is stronger for younger people, while the effect of effort expectancy is stronger for the older.

On the other hand, Lee et al. (2010) discovered that age only indirectly affects intention to use retail SCOs through consumer traits such as technology anxiety and need for interaction. To sum up, the significance of age still remains unclear and needs to be further investigated. In the present research context, it is assumed that age will play a significant role in SCO acceptance and needs to be included as a control variable.

Gender

Gender differences in shopping behavior have been widely researched. Venkatesh and Morris (2000) studied the differences through TAM framework and their findings suggest that men are more influenced by their perceptions of usefulness of the technology, while women focus more on perceived ease of use. This can be interpreted so that men may want to maximize the efficiency of their shopping trip by using SST, whereas women want to concentrate on doing their shopping with a minimum amount of external distraction, such as using a perceivably cumbersome SST. Results of Venkatesh et al. (2003) and Weijters et al. (2007) were consistent

with this, and also Lee et al. (2011) confirmed that gender has a similar influence on perceived ease of use and perceived enjoyment of an SST system. Although Martin (2012) did not confirm the significance of gender, it considered as a potentially relevant control variable to be taken into account.

Prior experience

The UTAUT model by Venkatesh et al. (2003) suggests that the effect of expected effort of using the system on behavioral intention decreases with increasing experience of system use. With increasing experience, user's skills to operate the system improve and the significance of perceived ease of use diminishes as the user becomes more familiar with the system. Later on, Venkatesh and Bala (2008) developed TAM 3 model which also confirmed experience to moderate IT adoption in a same manner, and additionally found increasing experience to amplify the effect of perceived usefulness. Reinders et al. (2008) showed that previous experience with SSTs in general leads to more positive attitudes toward SST solutions in railway stations.

Cho (2011) studied the how the effect of familiarity toward an SCO system moderates the effect of perceived usefulness and perceived enjoyment on consumers' attitude toward using SCO but found it to have no statistically significant influence. The finding is interesting, especially under perceived enjoyment, as one might expect the increasing usage experience to diminish the potential hedonic value the system might have. This calls for re-assessment in the present research context as SCOs are relatively new technology in Finland and consumers are still being accustomed to use them. Thus, it is reasonable to believe that increasing use experience will have an effect on the determinants of SCO adoption.

Need for interaction with service employees

The traditional checkout process includes a personal interaction between a customer and a service employee. This personal interaction in the checkout process is minimized or eliminated when using SCOs as the customer deals with a machine instead. The degree of need for interaction varies individually, as the personal human interaction in service delivery can be quite important for some consumers but some, on the other hand, may even try to avoid it. Therefore,

the personal need for interaction is potentially a significant psychographic factor influencing consumers' SCO acceptance.

Dabholkar and Bagozzi (2002) found that need for interaction did not moderate the relationship between perceived performance and attitude toward SST system. Phongkusolchit (2007) and Lee et al. (2010), on the other hand, discovered that a high need for interaction has a significant negative effect on intention to use retail SCOs. Lee et al. (2010) also found a positive relationship between age and need for interaction. Likewise, the findings of Meuter et al. (2005) suggest that need for interaction acts as a strong predictor for all the key mediators that directly determine consumer trial of SSTs. Some other studies have introduced similar constructs, such as "avoid service personnel" (Meuter et al., 2000), and discovered similar findings.

Typical number of items purchased

Weijters et al. (2007) studied the number of items purchased as a control variable on actual time spent in the store and perceived waiting time. Also here the number of items purchased is expected to influence the usage of SCOs. As the setting of this study does not provide the information of actual number of items purchased, the size of the shopping basket or cart is measured with the typical amount of items a consumer estimates to purchase during a one shopping trip. The results of Uitto (2011) imply that customers are more likely to use SCOs when purchasing only a small number of items.

Although Opara-Nadi (2005) did not find any significant difference in the mean number of items checked out by traditional tills and SCOs, the effect of this situational variable has not really been studied that much so far. Practical experience implies that the number of items has an effect of some extent of the use of SCOs. Furthermore, it is expected that no matter what the customer's intentions to use an SCO system are, the actual usage may be explained with the typical size of the shopping basket or cart, and thus it is justified to be included as a control variable.

3.2. Conceptual model

The proposed conceptual model illustrated in Figure 11 is constructed based on the research hypotheses stated and justified above. Constructs relevant for the present study (preference of

cash payment option, perceived enjoyment, perceived waiting time, and customer satisfaction) have been added to the core TAM model. The chosen control variables are presented above the research constructs. Since the proposed model is primarily attribute-based, the inclusion of attitudinal or psychographic variables is minimized. Need for interaction with a service employee is the only psychographic variable included. The findings of Simon and Usunier (2007) show, that the influence of personal thinking styles on SST preference is less significant when using less complex service. Checkout process can be considered as a simple service, so the above mentioned assumption suits the present research context.

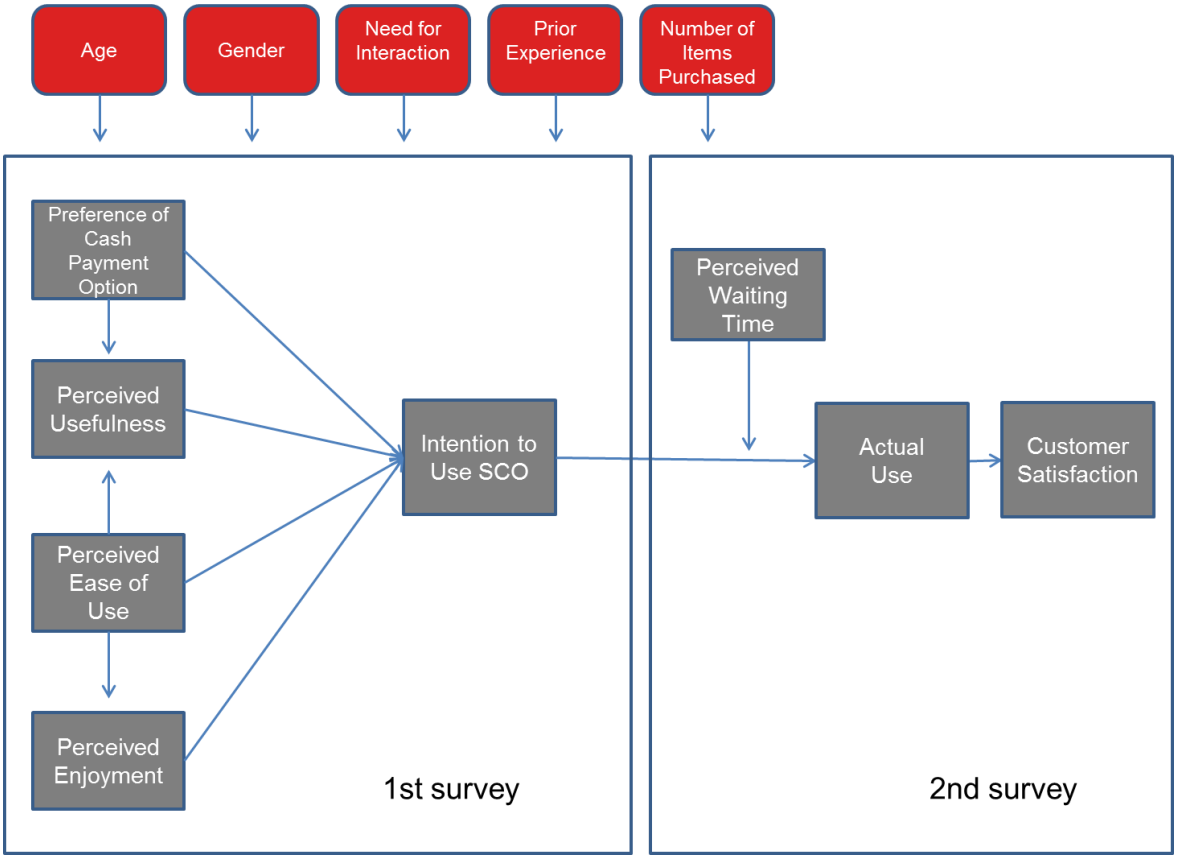

Figure 11: The proposed conceptual model

4. RESEARCH METHODOLOGY

4.1. Research instrument

A research instrument is needed for obtaining relevant information for a research project. Probably the most commonly used research instrument is a questionnaire but the instrument can also be e.g. an interview, observation, or content analysis (Wilkinson & Birmingham, 2003, 5). As the purpose of this study is to test the proposed research model and make conclusions in a generalizable manner, a large amount of quantitative data needed to be gathered. This can be done most efficiently with a closed-end questionnaire with scaled items. The most common questionnaire type is a mail survey which is potentially an efficient way of collecting large amounts of data (Wilkinson & Birmingham, 2003, 10). An even more efficient, convenient, and inexpensive method for data collection is a web-based questionnaire i.e. an online survey. According to De Leeuw et al. (1998), online surveys produce higher response rates than the traditional paper-based mail surveys. Therefore, online survey and analysis tool Webropol 2.0 was used for generating the questionnaire.

Studying the development of behavior by investigating the link between use intention and usage requires a longitudinal study with at least two measurement points. That is to say, the data needs to be gathered at two points in time to confirm whether intention to use actually leads to actual use of the system. Thus, two online consumer surveys were used for data collection. The first survey collected data on the behavioral intention to use and its expected determinants, as well as the control variables. The follow-up survey measured perceived waiting time, actual system use, and customer satisfaction. This kind of research design was chosen to eliminate the effects of common method variance (Podsakoff et al., 2003). The surveys were composed in Finnish as this study investigates Finnish consumers.

4.2. Measures

In both surveys, each research construct was measured with 3-5 reflective indicators i.e. statements formulated to describe the variable, apart from intention to use construct in the first survey, which was measured using only one indicator. Most of the items were composed to fit the purposes of this study, using items of earlier literature as a basis. Since most of the items

were generated particularly for this study and were therefore used for the first time, not all of the items performed adequately. Some particular items were too close to one another and thus were later dropped from the analysis when testing the measurement model. The items and their abbreviations are presented in Table 2.

Intention to use SCO was measured in both surveys. In the first survey, the construct was measured using a single item "I intend to use SCO in the future". In the second survey two more items were added. Confirmatory factor analysis was used to estimate the reliability of the item by using data from the second survey. The attained reliability value (0.77) for this indicator was used also for the first survey.

The Likert scale is one of the most popular approaches for measuring questionnaire statements and it was utilized here as well to measure respondents' level of agreement with each statement (Wilkinson & Birmingham, 2003, 12). All the constructs were measured using a five-point scale, ranging from "totally disagree" (1) to "totally agree" (5) (See Table 3 for the full scale). Options such as "not applicable", or "I don't know" were not provided, as the assumption was that every respondent has some kind of perception of every construct. Each question was mandatory to answer in order to complete the survey, so that no missing data would occur. Respondents were asked to answer the questions according to their own perceptions, regardless of whether they had used an SCO system before or not.

Demographic background of the respondents was measured in terms of age, gender, education, household size, and personal yearly income. Other relevant background questions measured prior experience of SCO usage in a grocery store, need for interaction with a service employee, and typical number of products purchased on one shopping trip. Scales of these background questions varied depending on the variable. Single questions were used for each variable and these were assumed to be measured without error.

Table 2: Research items

Construct	Items	
Perceived Usefulness (PU)	PU1*	SCOs are useful
	PU2	I do my grocery shopping faster when I use SCO
	PU3	I spend less time at the store if I use SCO
	PU4	Paying for groceries is more efficient using SCO
	PU5	Scanning and paying for groceries myself expedites getting out of the store
Preference of Cash Payment Option (CASH)	CASH1	I want SCOs to have the same payment options than the traditional checkouts
	CASH2	An opportunity to pay with cash would make SCO more useful
	CASH3	Sometimes I want to pay my groceries with cash
	CASH4	I would be more likely to use SCO if it had a cash payment option
Perceived Ease of Use (PEU)	PEU1	I believe that I can use SCO without problems
	PEU2	Using SCO is easy
	PEU3*	Using SCO is simple
	PEU4	Self-scanning products is effortless
	PEU5	Learning to operate SCO is easy
Perceived Enjoyment (PE)	PE1	Using SCO is fun
	PE2	Using SCO is entertaining because I can participate in the process
	PE3	Self-scanning products is fun
	PE4*	Self-scanning products is more enjoyable than going to a traditional checkout
	PE5	Checkout experience is more enjoyable, when I can do something myself
Intention to Use (IU)	IU	I intend to use SCO in the future
Perceived Waiting Time (WAIT)	WAIT1	SCOs reduce queuing
	WAIT2	I get to pay my groceries faster to SCO than to a traditional checkout
	WAIT3	If I want to reduce queuing, I will use SCO
	WAIT4	Using SCO enables lesser queuing
Actual Usage (USE)	USE1*	I have used SCO multiple times during this year
	USE2	I use SCO often when buying groceries
	USE3	I have started to use SCOs ever since it has been possible
	USE4	I pay my groceries at SCO whenever possible
Customer Satisfaction in Relation to SCOs (SAT)	SAT1	I am satisfied with the service provided by the store that has SCOs
	SAT2	I like buying groceries from a store that has SCOs
	SAT3	SCOs improve the service of the store
	SAT4	SCOs have a positive effect on my shopping experience

* Dropped item

Table 3: Item measurement scale

Scale	
Totally disagree	1
Somewhat disagree	2
Neither agree nor disagree	3
Somewhat agree	4
Totally agree	5

Table 4: Control variables

Control variable	Abbreviation
Age	AGE
Gender	GENDER
Need for interaction	NEEDINTR
Prior Experience	PRIEXP
Number of items purchased	NUMITPU

4.3. Administration of the online survey

Three samples were gathered from Sites 1-3, one of each store's customers. The grocery store chains collaborated on the data collection by agreeing to send a link to the online survey to their customer loyalty program members.

To maximize response rates, Wilkinson & Birmingham (2003, 16) recommend using a short cover letter that explains the research in a clear and understandable way and informs about confidentiality issues. Thus, a cover letter containing a link to the survey was created. The cover letter explained the research motivation and, to maximize the number of responses, promised gift cards for randomly selected respondents after the survey. In the mid of January 2013, the cover letter containing the link to the first online survey was distributed via e-mail by S-Group and Kesko to all those customer loyalty program members, who had used their loyalty cards during the past two months in the three stores discussed above. In the end of April 2013, another cover letter with a link to the follow-up survey was sent independently to those who gave their approval for it in the first survey. Again, gift cards were promised for randomly selected respondents of the follow-up survey as an incentive to participate the survey.

4.4. An overview to Structural Equation Modeling (SEM) techniques

Traditionally, researchers have utilized data analysis techniques such as linear regression, LOGIT, ANOVA and MANOVA which have been used as tools to find linkages and causalities between different phenomena. During the recent decades, these so called first generation techniques have increasingly been substituted with more advanced second generation data analysis techniques which will be presented next.

Structural Equation Modeling (SEM) techniques represent the second generation data analysis techniques, and they are becoming increasingly popular among information system researchers (Petter et al., 2007). Indeed, the use of SEM in central IS journals has increased notably (Gefen et al., 2000). According to Gefen et al. (2000), SEM methods such as LISREL, Mplus, and Partial Least Squares (PLS) have numerous advantages compared to the first generation models such as linear regression. Instead of correlations, SEM is based on analyzing covariance. SEM evaluates the measurement model in the same analysis than the structural model. SEM is considered to be better suited to characterize practical processes than the correlation-based models. This provides a more precise analysis of the research model as factor analysis and hypotheses are tested in the same analysis (Gefen et al., 2000, 6).

A SEM model consists of the measurement model and the structural model. The measurement model is used to define the latent variables and to assign measurement items to each construct. As the measurement model is analyzed, the fit of the model and the validity of the measurement items are ensured. SEM methods consider only reflective research constructs. A structural model consisting of reflective constructs is called a reflective model but if even one construct in the model is formative, the model is considered to be a formative model (Petter et al., 2007, 625).

Gefen et al. (2000) identify two techniques to carry out a SEM analysis; covariance analysis (used in e.g. Amos, EQS. LISREL, and Mplus) and partial least squares (used in PLS and PLS-Graph). They recognize three essential respects where these two techniques differ from each other: the objectives of their analyses, the statistical assumptions they are based on, and the nature of the fit statistics they produce. First of all, PLS method's statistical objective is, similarly to linear regression, to show high R^2 and significant t-values, so that the path-specific null hypotheses of no-effect are rejected. On the contrary, the covariance-based SEM is

determined to show that the null hypothesis of the entire proposed research model is plausible, while path-specific null hypotheses of no-effect are rejected (Gefen et al., 2000, 9). Thus, contrary to PLS, the objective of covariance analysis is to confirm that the proposed model is not disconfirmed by the data, but supported by it.

Moreover, Gefen et al. further state that covariance-based SEM techniques enable an assessment of unidimensionality, which uncovers possible shared variance among the items beyond the construct which they reflect. There should be no other significant correlation between a set of items reflecting the construct than the correlation associated with the construct itself.

4.5. The chosen data analysis method

As this study is based on testing hypotheses, quantitative methods were used to analyze the survey results. According to Gefen et al. (2000), SEM techniques are considered to be especially suitable for a model like TAM, as the core model and especially its extensions involve numerous relationships between the research constructs. Analyzing these kinds of complicated relationships would require two unrelated analyses when using first generation regression models. However, SEM techniques allow these paths to be modeled in one analysis and provide more comprehensive information of whether the research model is supported by the data.

Researcher's objectives determine which SEM technique is the most suitable for examining a research model. Hair et al. (2011, 143) recommend covariance-based SEM technique for "causal modeling situations where prior theory is strong and further testing and confirmation are the goals". This is the case with the present study. In addition, the proposed research model involves only reflective constructs which also makes it suitable for applying here. One of covariance-based SEM methods' limitations is that it doesn't work well with small samples (Hair et al., 2011, 143). However, the helpful collaboration by S-Group and Kesko made it possible to collect an exceptionally large sample, so covariance-based SEM was considered most suitable for the study. Therefore, a covariance-based SEM technique Mplus version 6.1 was chosen as a method for testing the proposed research model. Mplus has some key advantages over other covariance-based SEM techniques. In the Mplus approach, studying group invariance can be done in a single analysis, while using LISREL approach for instance, this process requires multiple stages (Muthén and Asparouhov, 2002, 15).

4.6. Approach for testing the model

The proposed research model (Figure 11) includes a moderating term; perceived waiting time to SCO option. As the main purpose of this study is to examine the link between intention to use and actual system use, as well as the moderating effect of perceived waiting time on actual use, the research model was run in two separate parts. Since this explicit interaction between intention, actual use, and waiting time is the main topic of interest here, it is reasonable to concentrate on it by analyzing it separately from the overall model. Thus, the model that is referred here to as "the full model" (Figure 12) considers perceived waiting time as a direct determinant of actual system use instead of a moderating term. The moderation is then investigated separately by studying "the simple model", illustrated in Figure 13. By doing so, unnecessary complexity of the overall structural model is avoided and the researcher can take a deeper look on the interactions of special interest.

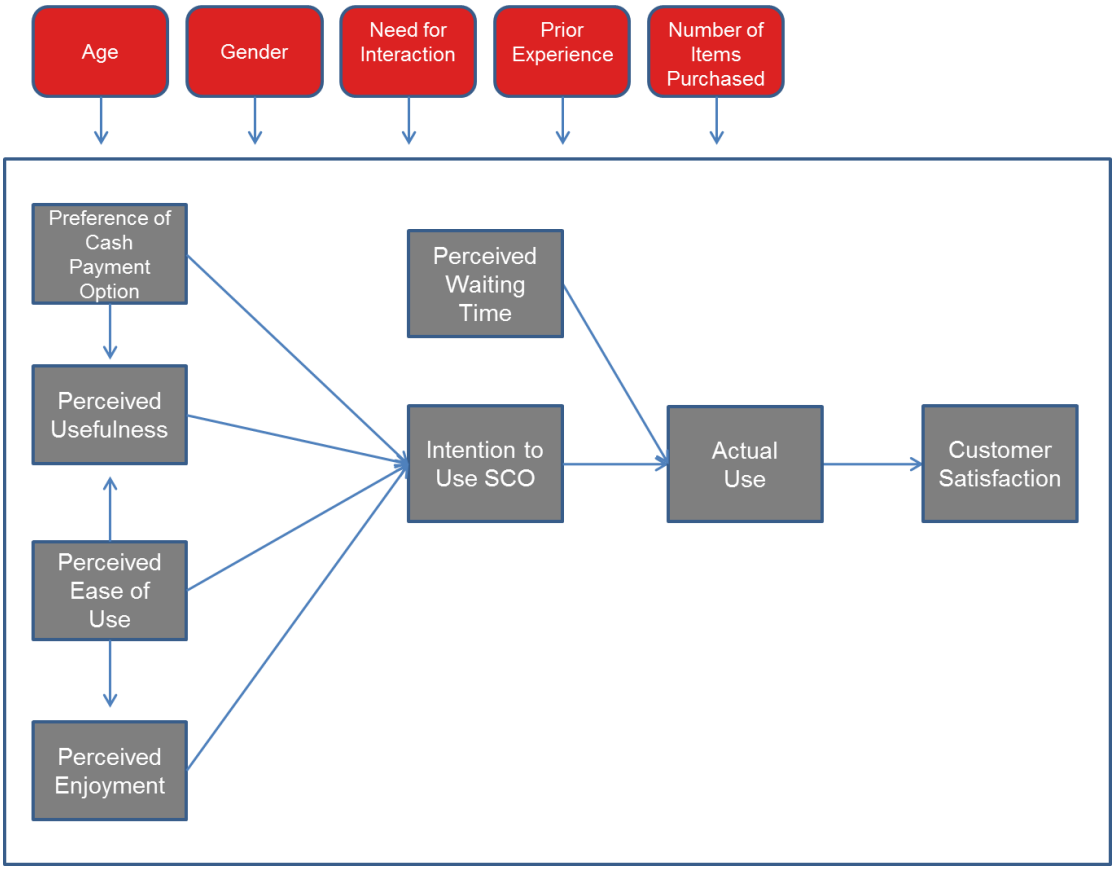

Figure 12: The full model (without moderation)

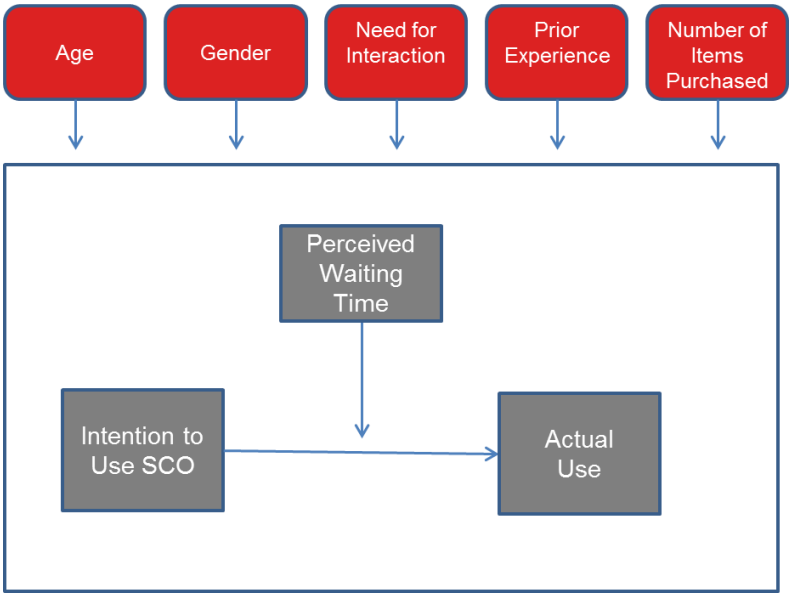

Figure 13: The simple model (with moderation)

5. EMPIRICAL STUDY

5.1. Data collection

As discussed, the online survey was distributed to all the stores' customer loyalty program members, who had used their loyalty cards in these stores during the past two months. Limiting the sample to S-Group's and Kesko's customer loyalty program members enabled collecting a large sample, as the link to the online survey was distributed to those members via e-mail by S-Group and Kesko. The second survey was sent independently by the researcher to those respondents, who gave their e-mail address and a permission to send the follow-up survey to the address given in the end of the first survey. To maximize response rates, the researcher sent two reminder e-mails before the response deadline to those who had not yet responded the follow-up survey.

The number of recipients, responses, and yielded response rates of each online survey are presented in the table below (Table 5). The first survey yielded good response rates of 23.1 % and 20.4 % from the Site 1 and 2 customers, respectively, and an acceptable rate of 9.2 % from the Site 3 customers. The significantly lower response rate of Site 3 may result from the fact that

the first online survey for the customers of Site 3 was sent one week later than for the customers of Sites 1 and 2. As Sites 2 and 3 are both located in Lahti, it is very likely that they share many loyal customers, who shop at both stores. Presumably many of the Site 3 survey recipients had already answered the survey that was sent to the customers of Site 2 and therefore did not answer the same survey again. The response rates of each follow-up survey were excellent, ranging from 53.4 % to 63.0 %.

Table 5: Responses to the online surveys

Site	Survey	Recipients	Responses	Response rate
Site 1	1st	5544	1278	23.1 %
	2nd	1086	684	63.0 %
Site 2	1st	4851	990	20.4 %
	2nd	825	490	59.4 %
Site 3	1st	9000	830	9.2 %
	2nd	684	365	53.4 %
Total	1st	19395	3098	16.0 %
	2nd	2595	1539	59.3 %

When looking into the data collected from the surveys, some duplicate responses were found as some e-mail addresses occurred twice in the responses. The duplicates were removed so that the second response from the presumably same respondent was deleted. Also some invalid responses were found by examining the averages of the measures. Some respondents had given the same value for each item in the study as they were probably motivated only to participate in the lottery for the gift cards and wanted to complete the survey as fast as possible in order to. These responses were considered as invalid, and were thus removed from the sample. No missing data occurred, as each question was mandatory to answer.

As such, the total numbers of valid responses from the first survey were following: 1277 from Site 1, 963 from Site 2, and 828 from Site 3. Moreover, the final usable response numbers from the follow-up survey were: 682 from Site 1, 489 from Site 2, and 363 from Site 3. Thus, the total sample used for testing the research model consists of 1534 responses.

5.2. Description of the sample

As the customer loyalty program members range in age, gender and social class, the sample can be considered quite representative of the whole population. There is no reason to assume that the loyalty program members would differ in any ways relevant to this study from those who are not members. In Finland, it is very common to have a loyalty card of either S-Group or Kesko or both, as S-Group for instance has over two million loyalty program members (*Aamulehti* 31.1.2013). Hence, limiting the sample to S-Group's and Kesko's customer loyalty program members does not affect the generalizability of the results.

The demographic information of the sample is presented in Table 6. The majority of the respondents were females (65 %) between 26-35 years old (24 %). Almost half (43 %) of the respondents had a third-degree education (university or polytechnic) and a more than third (36 %) had a yearly income of 30,000 – 49,000 €. Most of the respondents (73 %) were living either alone or in a household consisting of two people.

Table 6: Demographics of the sample

Demographic variable	Frequency (*n=1534*)	%
Gender		
Male	531	35 %
Female	1003	65 %
Age		
18-25	101	7 %
26-35	371	24 %
36-45	316	21 %
46-55	322	21 %
56-65	296	19 %
Over 65	128	8 %
Education		
Grammar school	224	15 %
Vocational school	450	29 %
Upper-secondary school	203	13 %
University or polytechnic	657	43 %
Yearly income		
Under 9,999 €	165	11 %
10,000 - 14,999 €	105	7 %
15,000 - 19,999 €	93	6 %
20,000 - 24,999 €	144	9 %
25,000 - 29,999 €	173	11 %
30,000 - 39,999 €	334	22 %
40,000 - 49,999 €	216	14 %
50,000 - 59,999 €	128	8 %
60,000 - 79,999 €	96	6 %
Over 80,000 €	80	5 %
Household size		
1	531	35 %
2	589	38 %
3	193	13 %
4	154	10 %
5	46	3 %
Over 5	21	1 %

Table 7 shows other relevant background information of the respondents. Almost half of the respondents (44 %) were customers of Site 1. Majority (68 %) had tried SCO before at least once

and every fifth (21 %) were regular users of retail SCOs. The most active SCO users were the customers of Site 1 as 27 % of them used SCOs regularly. In Site 2 and 3 the proportions of regular SCO users were notably lower, 17 % and 12 %, respectively. While over half (60 %) of the respondents did not mind interacting with SST interface instead of personal interaction, the rest (40 %) preferred personal human interaction. The customers of Site 3 showed the greatest need for interaction (45 % preferred to interact with a service employee), whereas the customers of Site 1 were the ones most oriented in using SSTs (no more than 37 % showed a high need for interaction).

Table 7: Background information of the sample

Background variable	Frequency (*n=1534*)	%
Customer of		
Site 1	682	44 %
Site 2	489	32 %
Site 3	363	24 %
Prior experience of SSC usage		
No experience	497	32 %
Has tried once or a few times	720	47 %
Uses regurlarly	317	21 %
Need for interaction		
Prefers personal interaction	621	40 %
Indifferent between interaction with a service personnel and a machine	870	57 %
Prefers to interact with a machine	43	3 %

5.3. Data analysis

The data was analyzed with Mplus 6.1. The first set of analyses was used to establish measurement invariance between the stores. This was done to ensure that the three datasets were similar enough to be analyzed jointly as the potential differences between the stores were not the primary interest for this study. In addition, the purpose of this study was to validate as generalizable model as possible. The multigroup analyses indicated that the patterns between the indicators and latent variables were sufficiently similar. Thus, the data could be pooled as one large dataset. Results of the measurement invariance test are presented in Table 8.

Table 8: Measurement invariance test

Model	χ^2	df	p	$\Delta\chi 2$	p	CFI	TLI	SRMR	RMSEA	90 ci		p<.05
Configural invariance	4552	1311	0.000			0.932	0.923	0.050	0.070	0.072	0.067	0.000
Weak factorial invariance	4638	1359	0.000	86	0.001	0.931	0.924	0.054	0.069	0.071	0.067	0.000
Strong factorial invariance	4792	1407	0.000	154	0.000	0.929	0.925	0.056	0.069	0.071	0.067	0.000

Anderson and Gerbing (1988) propose a two-step approach for structural equation modeling, and this approach was engaged here as well. Thus, a measurement model was analyzed first for ensuring the reliability and validity of the research constructs. This was done by performing a confirmatory factor analysis (CFA) of the latent variables used in the study. Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) indicate the fit between the data and the measurement model. Hu and Bentler (1999) suggest that CFI and TLI values greater or equal of 0.9 exhibit a satisfactory fit. The results of the first CFA were used to remove the items that did not perform well. Altogether four items were dropped based on an investigation of the modification indices in the analysis output. After this, another CFA was performed. The goodness-of-fit indices were within the recommended ranges and thus showed an acceptable model fit. Moreover, Table 9 presents the CFA loadings per item and shows that each item loaded significantly on the construct it was made to measure.

Table 9: Factor loadings

Items	Factor loadings
PU2	0.897
PU3	0.924
PU4	0.809
PU5	0.877
CASH1	0.544
CASH2	0.880
CASH3	0.625
CASH4	0.772
PEU1	0.757
PEU2	0.893
PEU4	0.761
PEU5	0.872
PE1	0.902
PE2	0.948
PE3	0.903
PE5	0.805
IU	0.872
WAIT1	0.826
WAIT2	0.891
WAIT3	0.873
WAIT4	0.924
USE2	0.906
USE3	0.944
USE4	0.892
SAT1	0.824
SAT2	0.900
SAT3	0.856
SAT4	0.906

Next, the full model was tested by performing a latent variable regression analysis where perceived waiting time was included as a direct determinant of actual system use. The researcher had no interest in studying the effect of perceived waiting time with any other variables but actual system use. Therefore, perceived waiting time was allowed to correlate freely with all exogenous latent variables and the error terms of the endogenous latent variables.

After this, another latent regression model was run where also the five control variables were included. Relevant model fit indices for the full model are shown in Table 10.

Table 10: Tested models, the full model

Model	χ^2	df	p	CFI	TLI	SRMR	RMSEA	90 ci		p<.05	AIC	BIC
CFA	1694	323	0.000	0.964	0.958	0.038	0.053	0.055	0.050	0.042	91820	92412
Direct effects	3062	338	0.000	0.929	0.921	0.123	0.072	0.075	0.070	0.000	93158	93670
Direct effects with controls	2822	434	0.000	0.941	0.928	0.077	0.060	0.062	0.058	0.000	109199	110052

After running the full model, a latent variable regression analysis was performed on the simple model to study the moderating effect of perceived waiting time on actual system use. Both the direct and moderating effect of perceived waiting time were analysed. This simple model included an interaction term between perceived waiting time and intention to use SCO. Since the moderation model was estimated with the LMS approach (Klein and Moosbrugger, 2000), fit indices are not available. All fit indices of the simple model (CFA, direct effects with and without controls) are presented in Table 11.

Table 11: Tested models, the simple model

Model	χ^2	df	p	CFI	TLI	SRMR	RMSEA	90 ci		p<.05	AIC	BIC
CFA	163	18	0.000	0.987	0.980	0.021	0.072	0.083	0.062	0.000	26549	26687
Direct effects	163	18	0.000	0.987	0.980	0.021	0.072	0.083	0.062	0.000	26549	26687
Direct effects with controls	326	43	0.000	0.978	0.960	0.018	0.065	0.072	0.059	0.000	43484	43810
LMS moderation with controls											43364	43695

5.4. Results

Table 12 shows the parameter estimates for the full model. Under Model 1 are the effects when the control variables are taken into account, Model 2 shows the overall effects without controls. All the main effects, except the path CASH → PU, are statistically significant on 99.9 % confidence interval and the effects are moderate or strong. The non-significant effect of preference of cash payment option on perceived usefulness does not come as a surprise as usefulness was measured mostly in terms of SCOs expediting the checkout process. Paying in cash is not practically related to this, except for the first initial PU item "SCOs are useful", which was, however, dropped from the model in the CFA phase. Thus, the non-significance is logical.

Behavioral intention to use SCOs is significantly determined by perceived usefulness, perceived ease of use, and perceived enjoyment, which all are positively related to IU, and preference of cash payment option, which is negatively related to IU. Perceived ease of use is the determinant of perceived usefulness and perceived enjoyment, consistently with Van der Heijden (2004). Intention to use and perceived waiting time both significantly determine the actual SCO usage. Actual SCO use is positively related to customer satisfaction in relation to SCOs.

The results support the existing TAM studies and further confirm the robustness of the TAM model. Therefore, the hypotheses 1-8 are supported (expect for H2, which is supported only partly).

Table 12: Full model regressions, standardized estimates

	Model 1	Model 2
PE -> IU	0.243***	0.263***
PEU -> IU	0.190***	0.307***
PU -> IU	0.332***	0.396***
CASH -> IU	-0.100***	-0.130***
PEU -> PE	0.370***	0.514***
CASH -> PU	0.015	-0.021
PEU -> PU	0.457***	0.645***
USE -> SAT	0.538***	0.740***
IU -> USE	0.267***	0.459***
WAIT -> USE	0.258***	0.410***
AGE -> IU	-0.077***	
GENDER -> IU	-0.013	
NEEDINTR -> IU	0.165***	
PRIEXP -> IU	0.155***	
NUMITPU -> IU	0.001	
AGE -> PE	-0.011	
GENDER -> PE	0.132***	
NEEDINTR -> PE	0.265***	
PRIEXP -> PE	0.020	
NUMITPU -> PE	0.028	
AGE -> PU	0.056**	
GENDER -> PU	0.018	
NEEDINTR -> PU	0.320***	
PRIEXP -> PU	0.090***	
NUMITPU -> PU	-0.001	
AGE -> SAT	-0.080***	
GENDER -> SAT	0.045*	
NEEDINTR -> SAT	0.216***	
PRIEXP -> SAT	0.033	
NUMITPU -> SAT	0.004	
AGE -> USE	0.026	
GENDER -> USE	-0.018	
NEEDINTR -> USE	0.099***	
PRIEXP -> USE	0.371***	
NUMITPU -> USE	0.016	

Note: *p < .05; ** p < .01; ***p < .001.

When looking at the control variables, age has a significant negative effect on IU and SAT, meaning that older people have a lower intention to use SCOs and are less satisfied with them than the younger. Gender has a strong effect only on PE, such that women consider SCOs more enjoyable to use than men. People with a low need for interaction have a higher intention to use SCOs, perceive them more useful and fun to use, are more likely to use them, and are more satisfied customers than the ones with a high need for interaction. The ones with more prior experience of SCO use perceived them more useful, had a higher intention to use them, and a higher actual usage. Number of items purchased does not have a significant effect on any of the variables.

Table 13: Simple model regressions, latent independent variables standardized

	Model 1	Model 2	Model 3
IU -> USE	0.239***	0.518***	0.454***
MOD -> USE			0.230***
WAIT -> USE	0.400***	0.503***	0.439***
AGE -> USE	0.029		0.027
GENDER -> USE	-0.022		-0.015
NEEDINTR -> USE	0.173***		0.106***
PRIEXP -> USE	0.531***		0.444***
NUMITPU -> USE	0.023		0.010

Note: *p < .05; ** p < .01; ***p < .001.

All the main effects, included in Table 13, are statistically significant and strong in the simple model. The hypothesized strong moderating effect (MOD) of perceived waiting time is confirmed and therefore H9 is supported. Model 1 shows the direct effects without moderation when the control variables are taken into account, Model 2 shows the estimates without controls, and Model 3 includes the controlled estimates with the moderation.

The nature of interaction effect is further clarified in Figure 14 that includes an interaction plot for perceived waiting time. The three lines show the estimated linear relationships between intention to use and actual use for three conditions of perceived waiting time: one standard deviation above mean (blue line), mean (green line), and one standard deviation below mean (red line). The plot demonstrates in a clear manner how the actual system use is a highly contextual

phenomenon. When the perceived waiting time is low, the actual system use remains low regardless of the intention to use. Moreover, the ones with low intention to use are not likely to use SCOs even when the perceived waiting time to SCO would be considered shorter than the time to traditional checkout at the moment. The link between intention to use and actual use is significant regardless of perceived waiting time but notably stronger when the waiting time to SCO is perceived as shorter than the waiting time to a traditional checkout.

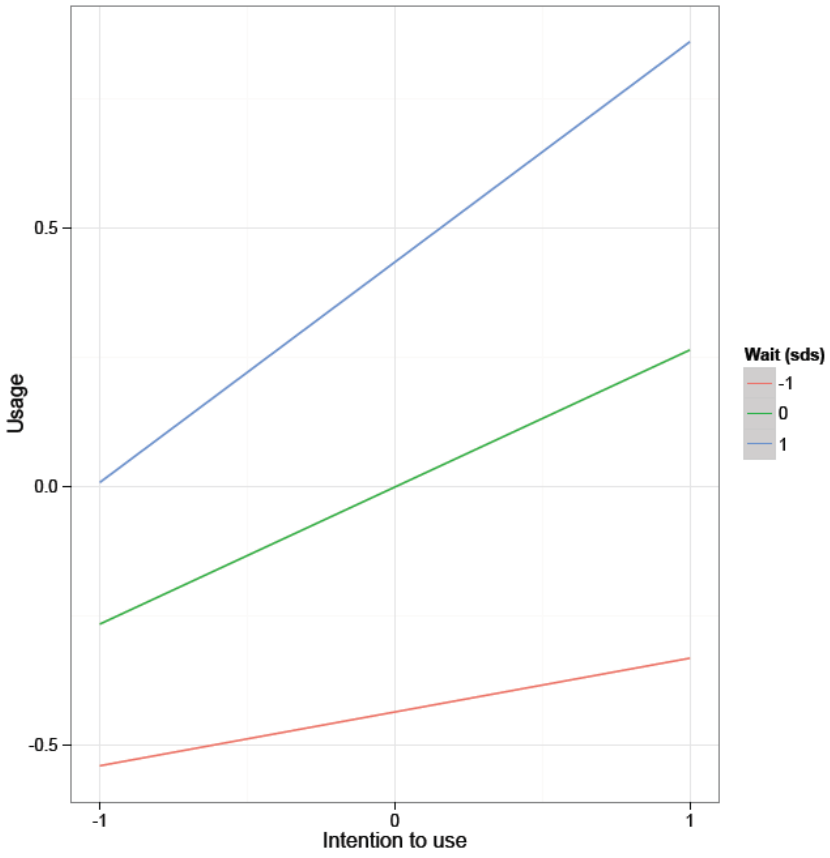

Figure 14: Interaction plot

To further test the reliability of the results, each analysis was repeated as two multigroup analyses using different criteria for grouping. This was done by grouping the responses by stores (Site 1; Site 2; Site 3) in the first analysis and then by prior experience (has not used; has tried; uses regularly) in the second analysis. Results from these analyses did not challenge any of the presented results and due to this are not reported separately here.

6. CONCLUSIONS

The final chapter includes conclusions based on the results reported above. First, a general overview on the key findings and conclusions will be provided. This is followed by theoretical implications, where the theoretical significance and contribution of the study's findings are discussed. Managerial implications provide practical interpretation of the results from business' point of view and suggestions for key issues to be considered when investing in SST. Finally, limitations of the study are discussed and suggestions for further research proposed.

6.1. Conclusions

This study set out to examine the determinants of intention to use and actual use of retail self-service technology, especially concentrating on the link between intention to use and actual use, and the moderating effect of a contextual variable. Based on earlier research on technology adoption, a research model was constructed around the TAM theory and nine hypotheses formulated. All of the research hypotheses were supported (although H2 only partly) by the results of the empirical study.

The robustness of the core TAM model was confirmed as perceived usefulness and perceived ease of use were expectedly significant determinants of behavioral intention to use. More interestingly, model's dimensions were successfully extended by investigating the effect of a contextual trigger, in this case perceived waiting time. The link between intention to use and actual system use was confirmed. However, the moderating effect of perceived waiting time was significantly strong. This suggests that intention to use only partly explains actual usage of a system. High intention to use is more likely to lead to actual use if some kind of activation mechanism works as a trigger causing the intention to turn into behavior.

The effects of additional constructs, perceived enjoyment and preference of cash payment option, were as hypothesized. Perceived enjoyment was a significant positive determinant of intention to use the technology. This finding highlights the importance of the hedonic dimension of technology use. An attractive usage experience is arguably one of the key factors determining user's desire to trial and commit into using the technology. The significance of enjoyment was especially stronger for female customers, which is consistent with Venkatesh and Morris (2000),

who suggested that women are more influenced by the hedonic aspect of shopping. Preference of cash payment option had a negative effect on intention to use the technology in question; meaning that people, who preferred to use cash, had a significantly lower intention to use self-service checkout system. This might be caused by the lack of cash payment option in the checkout systems currently used in the sites of this study. A person who prefers to use cash may be less likely to adopt an SCO system if it does not support cash payment.

Results show a strong positive relationship between actual use and customer satisfaction. This suggests that the ones using SCOs consider the system to improve the store's service quality. Moreover, it is probable that the customers who use SCOs do not feel being forced to use them but use them because they regard SCOs to enhance the checkout process. Since customer satisfaction has been proven to lead to customer retention and further to increased profits, this is an important finding from the point of view of business.

The significant positive effect of prior experience on intention to use and actual use is an expected finding and consistent with Meuter et al. (2005), who stressed the importance of trial in technology adoption. Generally, it can be inferred that SCOs are most likely to be adopted by young people who have low need for interaction with a service employee, and that increasing usage experience leads to increased use. Typical number of items purchased did not have a significant effect on any of the variables studied which is slightly surprising, although consistent with Opara-Nadi (2005). No significant effects were observed either, when running the multigroup analysis by grouping the responses by stores. As for Site 3, this was expected because the store provides SCO options for both basket and cart customers. However, Sites 1 and 2 have only the kiosk SCO system for basket customers with a small number of items, so a significant negative effect caused by the number of items would have been expected in these sites.

6.2. Theoretical implications

The adoption of technology has been studied through the TAM theory quite extensively, yet most of the research has been limited to the determinants of intention to use the technology. Especially in the SST context, the link between intention to use and actual use has been addressed notably little. As an attempt to fill this gap in the research field, this widescale

empirical study has investigated both the determinants of intention to use SST and the link between intention and actual use. This link was put under further scrutiny by studying the moderating effect of a contextual variable as an activation mechanism.

The applicability of the core TAM model was confirmed. Intention to use was significantly determined by perceived usefulness and perceived ease of use, and perceived usefulness was determined by perceived ease of use, as originally proposed by Davis (1989). Moreover, perceived enjoyment was a significant determinant of intention to use, consistent with e.g. Van der Heijden (2004) and Weijters et al. (2007). This indicates that there is indeed a hedonic dimension in using SST in retail setting which could be further addressed in future studies. Perceived enjoyment was also found to be determined partly by perceived ease of use, as suggested by Van der Heijden (2004). The finding that prior experience of system use has a strong effect on intention to use and actual use of the system is consistent with Cho (2011) and Venkatesh et al. (2003), and highlights the importance of user trial suggested by Meuter et al. (2005). Increasing experience of system use is a major determinant of its adoption.

This study did find a significant link between intention to use and actual use of technology. The finding was expected and in line with most of the previous research (e.g. Davis, 1989; Venkatesh et al. 2003). Surpising was, however, the significantly powerful moderating effect of the contextual variable perceived waiting time. The results indicate that perceived waiting time works as a trigger that activates the actual system use when the intention to use the system is high. Some individuals with a high intention to use are less likely to actualize their intentions into usage, if the usage behavior is not triggered by some external situational variable. The finding is particularly interesting, as majority of the research on technology adoption explains actual system use only with behavioral intention to use. However, it seems that intention to use does not sufficiently explain actual system use in this context. This somewhat challenges the common belief that intention to use will always lead to actual use. Moreover, the findings indicate that intention to use and actual use of the system are not always solely dependent on the attributes of the system but are also very significantly affected by contextual variables.

6.3. Managerial implications

As discussed in the introduction, a full-scale adoption of a technological innovation is often required for the investment to be profitable. The business benefits of the investment may never actualize if the system is left underutilized. Therefore, understanding the determinants of technology adoption is crucial for any business investing in IT systems.

As the utilization rate of a system is often the issue of main interest, it is absolutely necessary to understand how consumers' use intentions turn into actual use. This study confirms a significant link between intention to use and actual use but highlights the importance of contextual triggers that can be used to attract consumers to use technologies. Since queuing is an essential part of the grocery shopping process, perceived waiting time is one very relevant factor that can work as a trigger for technology usage in retail SCO context. Retailers should apply such triggers that would further consumers to switch over into using the new technology. One example of using such trigger is to present the expected or current waiting times to both traditional and self-service checkouts for the customers in the store. For instance, seeing that the expected waiting time to SCO is shorter may very well activate the consumer to use the SCO system.

Moreover, the results indicate that prior use experience of SCO system is positively and strongly related to the actual use of SCOs. Thus, the importance of getting non-user customers to try SCO for the first time is highlighted here. One practical approach to do this is to have employees picking customers randomly from the traditional checkout queue and guiding them in SCO use. Additionally, offering temporary discounts for selected products when checking out through SCO could be a way to attract non-users to try the system.

When investing in an SCO system, it is important to consider the method of payment supported by the system. The results show that consumers who prefer to use cash have a lower intention to use SCO than the ones who do not consider cash payment option necessary. Since it is possible that the lack of a cash payment option decreases some cash using consumers' SCO usage, retailers should take this into account when considering what kind of SCO system to invest in. Naturally the segment of potential cash-only-payers should be estimated carefully, the expected profitability calculated, and decisions on the system type be made based on that.

This study confirmed perceived enjoyment as one significant determinant of intention to use SCOs. This is something that retailers should take into account when investing in SCO technology. The enjoyment of using SCOs could be increased by attractive and aesthetic design of the SCO devices. SCO devices such as cart scanners could also provide the user with additional information of the products when scanning them. This would most likely enhance both perceived usefulness and perceived enjoyment of the system, and lead to increased use. Moreover, perceived ease of use was found to determine the enjoyment of using SCOs, so user-friendliness of the SCO interface must be ensured to get also the ones not so comfortable with technology to use the self-service option.

As large-scale utilization is necessary for an investment to turn out profitable, especially in retail SCO context, the factors discussed above should be carefully considered when investing in such system. The findings of this study show that customers who use SCOs are relatively more satisfied customers than the ones who do not use them. As the actual SCO use was found to be a significant positive determinant of customer satisfaction, it is vitally important for the retailers to find ways for getting the customers to trial and start using SCOs. The empirical evidence supports the claim that the usage rates of SCOs should be maximized in order to harness the potential business benefits.

6.4. Limitations and suggestions for future research

Background information of the sample presented in Table 7 reveals that the scale used for measuring need for interaction with a service employee was not the best possible one. Only 3 % of the respondents preferred interaction with a machine over interaction with a service employee. Majority of the respondents were indifferent between the two options. However, if asked whether one would prefer to withdraw cash from ATM or over bank counter, it is likely that the majority would choose ATM, thus preferring interaction with a machine. It is probable that the design of the question was not appropriate and due to this was somewhat misinterpreted by the respondents. Although the present measurement scale produced usable and valid results, more carefully designed question layout for measuring this control variable might produce more reliable data. On the other hand, the concept of retail self-service checkout is still quite new in Finland so estimating need for interaction may be challenging for consumers. Moreover,

intention to use SCO was measured with only one item in the first online survey. Although its reliability was later confirmed by measuring the intention again with three items in the follow-up survey, it may limit the generalizability of the results.

This study shares some of the fundamental limitations of the TAM theory. Foremost, as with most TAM studies, the technology usage and waiting time were measured using consumers' individual assessments of those variables. More reliable conclusions could be made by conducting a field research (as Weijters et al., 2007), where the actual usage of SCO, the actual number of items purchased, and the actual waiting times would be measured instead of using personal evaluations. Moreover, future research could take the approach even further by applying contextual triggers in a real-life field setting which may or may not activacte a certain behavior in a consumer. As discussed in the managerial implications section, these triggers could be executed by presenting the customers the expected waiting times for both SCOs and traditional checkouts in the store, and see how displaying these expected durations would affect the real-life behavior. This was not possible in the present research context. Moreover, future models on technology acceptance should take into account such contextual factors that are expected to have an effect on the actual use and the adoption of technology in general. More detailed exploration of activation mechanisms and testing them in future empirical studies is called for.

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APPENDIX A: THE FIRST SURVEY

Note: The survey is translated from Finnish to English. Only the sections in the survey utilized in this study are included.

Self-Service Checkout Questionnaire

Age *

- < 18 years
- 18 - 25 years
- 26 - 35 years
- 36 - 45 years
- 46 - 55 years
- 56 - 65 years
- 66 - 75 years
- > 76 years

Gender *

- Male
- Female

Education *

- Grammar School
- Vocational School
- Upper-secondary school
- University or polytechnic

Household size *

- 1
- 2

- 3
- 4
- 5
- >5

Yearly income *

- < 9999 €
- 10 000-14 999 €
- 15 000-19 999 €
- 20 000-24 999 €
- 25 000-29 999 €
- 30 000-39 999 €
- 40 000-49 999 €
- 50 000-59 999 €
- 60 000-79 999 €
- > 80 0000 €

Have you used a self-service checkout system in a grocery store? *

- No
- Yes, I have tried once or a few times
- Yes, I use often

Personal interaction*

- I prefer personal interaction with a service employee over interaction with a machine
- I am indifferent between interacting with a service employee and a machine
- I prefer interacting with a machine over interaction with a service employee

Next you will be presented statements related to the use of self-service checkouts (SCOs). Each statement has five response options of which you can choose only one. Please answer according to your own intuition, even if you have not used self-service checkout before.

Usefulness of SCOs *

	Totally disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Totally agree
SCOs are useful					
I do my grocery shopping faster when I use SCO					
I spend less time at the store if I use SCO					
Paying for groceries is more efficient using SCO					
Scanning and paying for groceries myself expedites getting out of the store					

Payment options *

	Totally disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Totally agree
I want SCOs to have the same payment options than the traditional checkouts					
An opportunity to pay with cash would make SCO more useful					
Sometimes I want to pay my groceries with cash					
I would be more likely to use SCO if it had a cash payment option					

Ease of use *

	Totally disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Totally agree
I believe that I can use SCO without problems					
Using SCO is easy					

Using SCO is simple					
Self-scanning products is effortless					
Learning to operate SCO is easy					

Enjoyment *

	Totally disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Totally agree
Using SCO is fun					
Using SCO is entertaining because I can participate in the process					
Self-scanning products is fun					
Self-scanning products is more enjoyable than going to a traditional checkout					
Checkout experience is more enjoyable, when I can do something myself					

Intention to use *

	Totally disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Totally agree
I intend to use SCO in the future	○	○	○	○	○

Please fill your e-mail address to the box below if you want to participate in the lottery of gift cards.

The winners will be informed personally. The address will not be used for advertising purposes.

E-mail:

You will receive a short follow-up questionnaire related to the study in approximately two months, if you tick in the box below. Your help would be highly appreciated!

☐ Yes, I give my permission for sending a follow-up survey to the e-mail address I have given above. Gift cards will be raffled also among the participants of the follow-up survey. After that the research project is completed and no more questionnaires will be sent. The e-mail address will not be used for other purposes.

APPENDIX B: THE FOLLOW-UP SURVEY

Note: The survey is translated from Finnish to English. Only the sections in the survey utilized in this study are included.

Self-Service Checkout Follow-Up Questionnaire

How many products do you buy on one typical shopping trip? *

*A full shopping **basket** contains 16-20 products on average.*
*A half-full shopping **cart** contains 30 products on average, a full cart +50 products.*

- 1-5
- 6-10
- 11-15
- 16-20
- 21-30
- 31-40
- over 40

Next you will be presented statements related to the use of self-service checkouts (SCOs). Each statement has five response options of which you can choose only one. Please answer according to your own intuition, even if you have not used self-service checkout before.

Waiting time *

	Totally disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Totally agree
SCOs reduce queuing					
I get to pay my groceries faster to SCO than to a traditional checkout					
If I want to reduce queuing, I will use SCO					

Using SCO enables lesser queuing					

Actual use of SCOs *

	Totally disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Totally agree
I have used SCO multiple times during this year					
I use SCO often when buying groceries					
I have started to use SCOs ever since it has been possible					
I pay my groceries at SCO whenever possible					

Intention to use SCO *

	Totally disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Totally agree
I intend to use SCO in the future					
It is likely that I will buy my groceries using SCO from now on					
I will be using SCO whenever I am going to a grocery store					

Customer satisfaction *

	Totally disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Totally agree
I am satisfied with the service provided					

by the store that has SCOs

I like buying groceries from a store that has SCOs					
SCOs improve the service of the store					
SCOs have a positive effect on my shopping experience					

Please write your free comments regarding self-service checkouts in the box below:

Please fill out your contact information below if you wish to participate in the lottery of gift cards.

Name

Address

Postal/zip code

City