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# CUSTOMERS' USAGE OF SELF SERVICE TECHNOLOGY IN A RETAIL SETTING

BERT WEIJTERS
Bert.Weijters@vlerick.be
NIELS SCHILLEWAERT
Niels.Schillewaert@vlerick.be
DEVARAJAN RANGARAJAN
Deva.Rangarajan@vlerick.be
TOMAS FALK

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BERT WEIJTERS
Vlerick Leuven Gent Management School
NIELS SCHILLEWAERT
Vlerick Leuven Gent Management School
DEVARAJAN RANGARAJAN
Vlerick Leuven Gent Management School
TOMAS FALK
Mannheim Business School

**Contact:**
Bert Weijters
Vlerick Leuven Gent Management School
Tel: +32 09 210 98 76
Fax: +32 09 210 98 75
Email: Bert.Weijters@vlerick.be

## ABSTRACT

The last decade has seen an increased focus by retailers on using new technologies to deliver their services. The introduction of self-service technologies (SSTs) opens up for retailers the potential of improving productivity and service quality while cutting costs. However previous forays by retailers to get their customers to try these self-service technologies have not been proven to be quite successful. Previous empirical research on the usage of technology based self-services has mainly focused on antecedents of attitude towards and corresponding behavioral intentions to use. However, little empirical research has linked these variables to actual behavior in a real life setting. To address these issues, we collected a combination of survey and observational data using self-scanning lanes as objects of investigation. We identify ease of use, usefulness, fun, and reliability as drivers of attitude towards the SST, which in turn significantly predict actual usage of the SST. We also extend previous research by focusing on the moderating effects of age, education and gender as key demographic variables. Finally, we contribute to the literature by studying the consequences of SST use from the customers' point of view.



Keywords: self-service technology, retailing, consumer attitudes and behavior

The rapid acceptance of modern information and communication technologies in daily business activities is an important long-term trend in the business world (Rust, 2001). Consequently, retailers are increasingly considering innovative options for delivering service to their customers (Bobitt and Dabholkar 2001; Dabholkar, Bobitt, and Lee 2003; Quinn 1996). As a result, the mode of service provision and production is increasingly turning towards the use of self-service technologies (SSTs), thereby enabling customers to produce a service encounter independent of direct service employee involvement (Meuter et al. 2005). Prominent examples for the increased usage of SSTs in retail settings are self-scanning and online shopping (Childers et al. 2001; Dabholkar, Bobitt, and Lee 2003).

The infusion of technology is dramatically changing the nature of service encounters which has been traditionally conceptualized as a "high-touch, low-tech" phenomenon (Bitner, Brown, and Meuter 2000). Within technology-based self-services, man-to-man interaction is to a greater extent substituted by man-machine interaction (Bitner, Brown, and Meuter 2000; Meuter et al. 2000). Through this, customers appear as co-producers in the value creation process which offers both customers and service retailers substantial advantages (Vargo and Lusch 2004). From a customer's point of view these benefits are reflected mainly by increased flexibility, greater control, and time savings compared to the traditional service options (Meuter et al. 2000).

In return, getting the customer to do more work is particularly for retailers, an opportunity for overcoming two major problems resulting from human interaction in traditional service encounters. First, the introduction of SSTs allows handling varying demand without the expensive adjustment of employee levels (Curran, Meuter, and Surprenant 2003). Second, the service is standardized till the point of customer interaction with the technological interface, which leads to more calculable service atmosphere independent of employees' personality and mood. This enables customers to specify their expectations towards the service in general.

As a result, the introduction of SSTs opens up for retailers the potential of improving productivity and service quality while cutting costs. However, the extent to which this potential can be exploited depends largely on customers' willingness to accept and adopt the technology-based service option.

Despite increased focus of retailers on SST, many retailers struggle to increase the number of SST users (Curran, Meuter, and Surprenant 2003). Given this challenge and the fact that the introduction of technology-based self-services is resource intensive, it is of utmost importance for retailers to understand the drivers of SST usage. Surprisingly,

empirical research on factors affecting customer usage of SSTs in a retail setting is quite limited (Dabholkar, Bobbitt, and Lee 2003). Existing research has either focused on experimental settings using student samples (Dabholkar and Bagozzi 2002) or critical incidents analysis (Meuter et al. 2000) as key sources of data, and little empirical research has linked attitudes towards SST to actual behavior in a real life setting. To address these issues, we collected a combination of survey and observational data in a retail setting. Another key contribution of our study is the focus on the impact of demographic variables on the SST usage process. To the best of our knowledge, most studies on SST usage have underplayed the role of demographic variables on the attitude formation process. This is surprising considering the fact that literature on adoption of technologies within organizations has established the key role played by demographics (Morris and Venkatesh 2000; Venkatesh and Morris 2000). In an effort to address the gap in the literature, our study focuses on the moderating influence of demographics (education level, age and gender) on the attitude formation process.

Another key contribution of our study is the exploratory focus on the consequences of technology usage. While previous work on SST has mainly focused on intentions to use SST, to the best of our knowledge little empirical research has gone into studying the outcomes associated with using the technology. While anecdotal evidence suggests that one of the advantages of using SSTs is the reduction in customer waiting time at the check out register, thereby contributing to their levels of shopping experience (Zeithaml and Bitner 2003), empirical evidence to verify this claim is still limited. In this study we address this issue by studying customer perceptions of waiting time for both users and non users of SST and the effect that this has on the level of satisfaction exhibited by the customers with the shopping experience.

In the next section, we will review the existing literature on SSTs and the adoption of innovations. Next, we offer the rationale for our conceptual model. The moderating role of the demographic variables, as well as the outcomes of SST use are then discussed. This is followed by the methods section where we describe the process by which data was collected and analyzed. The results section highlights the findings of our data collection efforts. The penultimate section focuses on the discussion of our results. We conclude our article by identifying limitations of the present research and offer suggestions for future research.

## LITERATURE REVIEW

Researchers have increasingly started to examine the usage of SSTs in service encounters (e.g. Bateson 1985; Curran, Meuter, and Surprenant 2003; Dabholkar 1994, 1996; Dabholkar and Bagozzi 2002; Dabholkar, Bobitt, and Lee 2003; Meuter et al. 2000, 2003, 2005; Parasuraman 2000). While early works emphasized the self-service phenomenon itself (e.g. Bateson 1985), current studies focus on customer satisfaction with SSTs (Meuter et al. 2000) and the adoption of technology-based self-services (e.g. Curran, Meuter, and Surprenant 2003; Dabholkar and Bagozzi 2002; Dabholkar, Bobitt, and Lee 2003; Meuter et al. 2005).

In an empirical study Bateson (1985) investigated consumers' decision process when faced with the choice between a self-service option and a more traditional service delivery system. The results of Bateson's study highlighted the importance of perceived time taken, perceived control of the situation, and perceived effort as choice criteria for choosing the self service option. While these findings offer clues with respect to the determinants of self-service usage, they have to be verified in a technology dominated service context.

Previous research suggests that users of technology vary in their reaction towards the technology, which subsequently affects their subsequent behavior towards it (Davis et al. 1989; Mick and Fournier 1998; Venkatesh and Davis 2000). Mick and Fournier (1998) identify eight technology paradoxes which reflect both consumers' positive and negative feelings triggered by technology: control/chaos, freedom/enslavement, new/obsolete, competence/incompetence, efficiency/inefficiency, fulfill/creates needs, assimilation/isolation and engaging/disengaging. The idea of a coexistence of these positive and negative feelings about technology was adopted by Parasuraman (2000), in developing the technology readiness index (TRI) as a multiple-item scale for assessing people's readiness to interact with technology.

In line with the ambivalent results technology Meuter et al. (2000) analyze the drivers of customer satisfaction and dissatisfaction with technology-based service encounters. By means of critical incident techniques, they identify ease of use of the technology, saved time/money, and increased flexibility as the most important variables contributing to satisfaction. On the other hand, technology and process failure as well as poor interface design were seen as the most dissatisfying factors.

Research on the adoption of SSTs mainly builds on the technology acceptance model (TAM; Davis, Bagozzi, and Warshaw 1989). Within the TAM model, Davis et al. (1989)

identify two fundamental constructs for forecasting the adoption of computer technology in an organizational setting: perceived usefulness of the technology and perceived ease of use of the technology. However, there is empirical evidence that a more complex set of antecedents is necessary for explaining technology adoption (e.g. Featherman and Pavlou 2003; Gefen, Karahanna, and Straub 2003; Venkatesh et al. 2003).

A recent study conducted by Meuter et al. (2005) investigated key drivers that determined the initial SST trial decision by users. The authors introduce the concept of consumer readiness, "a condition or state in which the consumer is prepared and likely to use an innovation for the first time" (Meuter et al. 2005, p. 64), as an important factor for the initial adoption decision. Based on two empirical studies, the mediating role of consumer readiness between established adoption determinants and the likelihood of trial was proven.

Although there is a growing body of research exploring SST acceptance and adoption, there is still much to be learned about customer interplay and usage behavior with technology-based self service systems. The majority of studies investigating determinants of SST usage represents extensions of the traditional TAM model highlighting customers attitudes toward the technology as a way to foresee behavioral intentions (Childers et al. 2001; Curran, Meuter, and Surprenant 2003; Dabholkar and Bagozzi 2002; Plouffe, Hulland, and Vandenbosch 2001). Going beyond the emphasis on attitudes and behavioral intentions in the existing literature, our study links attitude to use a SST to actual behavior in a real life setting and the consequences of SST usage, as suggested by Meuter et al. (2005). Moreover, most studies on SST usage have ignored the role of demographics variables on the attitude formation process. This research gap is addressed by including demographic variables as moderating factors in our conceptual model.

Insert Figure 1 About Here

## HYPOTHESIS DEVELOPMENT

Figure 1 gives an overview of our conceptual model.

### Antecedents of Attitude Towards SST

A review of the literature on individuals using technology reveals that the ease with which users can handle the technology positively affects their attitude towards it. This has proven to be true in research on organizational behavior (Davis, Bagozzi, and Warshaw 1989; Venkatesh and Davis 2000), in consumer behavior (Mick and Fournier 1998), and in research on SSTs (Dabholkar 1994; Dabholkar and Bagozzi 2002). As a result, we identify ease of use as a key independent variable affecting customer attitudes to SST.

Ease of use refers to the process leading to a final outcome, which is represented by the variable perceived usefulness in our model. While Dabholkar and Bagozzi (2002) indicate the inappropriateness of using perceived usefulness in a technology based self-service context, we suggest that when faced with the choice of using SST, users tend to focus on the potential benefits that the technology has to offer. This is in line with research conducted by Childers et al. (2001), who identify usefulness as a major driver of the attitude towards a SST. In a retail shopping context, individuals are likely to focus on time benefits associated with using SSTs to form attitudes about the technology. In view of this we suggest the following hypothesis:

*H1: Perceived ease of use of the SST is positively related to attitude towards the SST.*

*H2: Perceived usefulness of the SST is positively related to attitude towards the SST.*

A more recent stream of research has introduced the hedonic aspect of using self-services and focused particularly on the enjoyment aspect of using technology (Childers et al. 2001; Dabholkar 1994; Dabholkar and Bagozzi 2002). Enjoyment refers to the extent to which the activity of using technology is perceived to provide reinforcement in its own right, apart from any performance consequences that may be anticipated (Davis, Bagozzi, and Warshaw 1989). Enjoyment has been reported to influence technology adoption for technology usage at the working place. This idea of technology adoption is also consistent with research on retail shopping behavior, which has held up the presence of both utilitarian and hedonic shopping motivations (Wolfinbarger and Gilly 2003). While the utilitarian aspect

is already represented by the usefulness construct, more goal-oriented factor, enjoyment is added to reflect the hedonic aspect of using SSTs in a retail shopping setting. As there is strong evidence in the literature for the significant effect the fun aspect has on the attitude formation towards using technology based self-services (Childers et al. 2001; Dabholkar and Bagozzi 2002), we propose that customers who perceive the aspect of using self-scanning devices as a fun way of shopping are likely to have favorable attitudes towards the technology:

*H3: Perceived fun of using the SST is positively related to attitude towards the SST.*

Drawing on insights from the literature on service quality in general, and electronic service quality in particular, we further suggest integrating the perceived reliability/fulfillment of the technology based self-service as a determinant of the attitude towards the SST (Parasuraman, Zeithaml, and Berry 1988; Parasuraman, Zeithaml, and Malhotra 2005; Wolfinbarger and Gilly 2003; Zeithaml, Parasuraman, and Malhotra 2002). Reliability represents a major determinant of overall electronic service quality and refers to the correct technical functioning of a SST and the accuracy of service delivery. The critical part of reliability/fulfillment in consumer acceptance of technology-based self service options has been put forward by Dabholkar, Bobitt, and Lee (2003). Thus, in keeping with our arguments, we propose the following hypothesis:

*H4: Perceived SST reliability is positively related to attitude towards the SST.*

A wide stream of research has shown that people differ in the extent to which they like new products (Steenkamp and Baumgartner 1992; Rogers 2003), especially new technologies (Parasuraman 2000). Haines (1966) found that 25 percent of those trying a product for the first time reported that they had bought the product “because it was new”, lending support to the idea that the diffusion process gets started by innovative people (i.e. there is a demand for newness per se). This provides considerable support to the idea that newness is desirable for itself, at least to some people and therefore a potential driver of SST usage. Newness is an attribute accorded to a product or a service by an observer (Blythe 1999). Therefore newness is derived from two factors; the characteristics of the service, and the characteristics of the observer. What is new to one person may not be new to another and it may be possible for one observer to accord a greater degree of newness to a given service

than would another. We define perceived newness as the extent to which a solution is perceived as being new and innovative, i.e. more recent and at the same time different from previously known solutions and include perceived newness of the SST as a belief affecting attitude towards the SST. It is important to note that we do not hypothesize a specific main effect of perceived newness on attitudes. Rather, as will be discussed in the next section, we expect to find perceived newness positively affects attitude for some segments, while negatively affecting attitude for other segments.

**Use of SST**

Customer intention to use SST depends on organized attitude structures (Curran, Meuter, and Surprenant 2003). Fundamental research on the outcomes associated with attitudes has mainly focused on intention as a key predicted variable. Literature in social psychology and consumer behavior draw heavily on TRA (Fishbein and Azjen 1975) to understand the attitude-intention link. In a technology-related literature stream, the widely cited TAM model (Davis 1989) suggests that individuals who form favorable attitudes, demonstrate higher levels of intention to use the technology. In a SST context, Dabholkar and Bagozzi (2002) provide evidence to support the positive relationship between attitudes and intentions. Moreover, research in the field of social psychology (Fishbein and Azjen 1975; Ajzen 2002) has established the predictive validity of intention on behavior. In line with Mick's (2003) call to combine mental processes with actual behavior, we therefore link the self-reported attitude towards the usage of SST to observed use of the SST. In keeping with these findings, we hypothesize that:

*H5: Attitude towards the use of SST is positively related to the actual use of the SST.*

**Moderating effects**

In the domain of technology adoption, researchers have either studied main effects of demographics (e.g. Darian 1987; Eastlick 1993; Fram and Grady 1997; Stevens, Warren, and Martin 1989) or dismissed their relevance (Dabholkar and Bagozzi 2002). We believe it is important to study how the technology usage process differs across demographic segments, as it has been done in an organizational context (Morris and Venkatesh 2000; Venkatesh and Morris 2000). A better understanding of the moderating effect of demographics has both theoretical and practical value. While focusing on personality traits of users of SST is

interesting (Dabholkar and Bagozzi 2002), demographic variables are more readily identifiable in practice and therefore more actionable (Wedel and Kamakura 2000; Mittal and Kamakura 2001). Since generalization of specific domain-based findings to different settings is at the heart of theory development, we believe that it would be extremely interesting for us to test whether findings from organizational behavior apply to the use of SST's by customers in a retail setting.

***Education***

People differ in their sensitivity to time-related issues (Berry, Seiders, and Grewal 2002; Hui and Tse 1996). Durrande-Moreau and Usunier (1999) indicate that people who have more highly qualified jobs and education levels tend to display a more quantitative time orientation, as reflected in the statement "time is money". We hypothesize that higher educated people will try harder to optimize their time allocation and thus feel more time pressure. This will lead them to attach more importance to the time gain that comes with using SST.

*H6a: The positive relation between perceived usefulness and attitude towards using the SST is stronger among higher educated customers than among lower educated customers.*

Newness of SST in itself may have some utility for customers (Blythe 1999). Higher education has generally been found to be positively associated to a higher probability of using new technologies (Im, Bayus, and Mason 2003; Rogers 2003). Taken together, these lines of thoughts lead to the hypothesis that perceived newness of an SST will positively affect attitudes towards the SST of higher educated people, while negatively affecting attitudes towards the SST of lower educated people.

*H6b: The relation between perceived newness of a SST and attitude towards the SST is positive for higher educated people, and negative for lower educated people.*

***Age***

We believe the impact of perceived newness on attitude may also be moderated by age. As discussed above, Blythe (1999) suggests that to some people newness is desirable for itself. Consistent with a rich body of research, Im, Bayus and Mason (2003) find that younger

customers have a higher chance of purchasing and using new consumer electronic products. This seems to indicate that younger customers may be the people implied by Blythe, namely those to whom newness as such is a desirable attribute. Thus we expect that younger people positively evaluate newness, while older people evaluate it negatively. To the best of our knowledge, this idea has not been explicitly tested. As a result, we study the moderating effect of age on the relation between perceived newness of the SST and attitude towards using it.

*H7a: Younger customers' attitudes towards using SST are positively related to perceived newness of the SST, while older customers' attitudes towards using SST are negatively related to perceived newness of the SST.*

In a workplace setting, Morris and Venkatesh (2000) show that the relation between attitude and intention is not equally strong for all people. More specifically, they find that intention to use technology is more strongly driven by attitude among younger people as compared to older people. We test whether this finding is transferable the attitude-behavior link in a retail setting and suggest:

*H7b: Younger customers' actual usage of the SST is more strongly related to their attitude towards using the SST than is older customers' actual usage of the SST to their attitude towards using the SST.*

***Gender***

Over the years, an increasing body of research has studied gender differences in shopping behavior. It has been found that males and females employ different information processing strategies while shopping (Meyers-Levy and Maheswaran 1991; Meyers-Levy and Sterthal 1991). Some researchers have suggested that females generally show higher involvement and more thorough information processing in shopping than do males (Laroche et al. 2000; Laroche et al. 2003). This might possibly translate into different priorities while shopping, in that males may want to minimize time and effort invested, while females may want to minimize distraction from the shopping task. In relation to SST use, this would imply that males attach more importance to making their shopping more efficient by using SST, while females would not want to impede their shopping task performance by having to use the SST. Evidence from a different context leads to similar conclusions. Venkatesh and

Morris (2000) studied gender differences in the context of technology acceptance in the workplace. They found that, *"[…] compared to women, men's technology usage decisions were more strongly influenced by their perceptions of usefulness. In contrast, women were more strongly influenced by perceptions of ease-of use […]"* Based on these two lines of reasoning, we hypothesize a moderating effect of gender on the importance of perceived usefulness and perceived ease-of-use in the formation of attitude and intention. Thus,

*H8: As compared to women, men's attitude towards using SST is more strongly related to perceived usefulness.*

**Outcomes of SST Usage**

In the third part of our conceptual model, we focus on the outcomes of SST use. More specifically, we expect SST use to affect perceived waiting times at the check-out. Perceived waiting time, in turn, is assumed to have an impact on satisfaction with the shopping trip. These relationships are discussed in more detail below. We now further focus on perceived waiting time and satisfaction.

Zeithaml and Bitner (2003) point out the importance of time spent by customers during a service experience. They suggest that customers often look for quick and efficient service and do not expect to spend a lot of time waiting. Therefore, it is crucial to investigate the effect of SST use on the perceived waiting time. In the domain of SST, reduction in time spent during the service experience is the main advantage delivered by using SST (cfr. the discussion leading to hypothesis 1). In a retail setting, self-scanning delivers its main advantage by reducing waiting times at check out (Dabholkar, Bobbitt, and Lee 2003). As a result, we argue that SST users are likely to perceive that they will spend less time waiting in the check-out counters.

*H9: Perceived waiting time at the cash register is lower among SST users than among non-users.*

Waiting times have been shown to strongly affect evaluations of service encounters by customers (Taylor 1994; Zeithaml and Bitner 2003). Durrande-Moreau and Usunier (1999) point out, "the wait is a minor but significant part of the overall service encounter that influences customers' global evaluation of the service…". When SST users and non-users

perceive that they spend less time waiting in the counter, they exhibit higher levels of satisfaction with the overall shopping experience. Subsequently, we believe that the perceived waiting time will in fact affect the satisfaction experienced by the user with the shopping experience.

*H10: Overall satisfaction with the shopping trip is negatively related to perceived waiting time.*

Zeithaml and Bitner (2003) suggest that the level of satisfaction with a service encounter, is affected by the amount of time customers have to wait for the service to be provided. As mentioned earlier, one of the primary reasons for consumers to use SST is to save time at the cash register. This indicates that SST users can be expected to attach more importance to waiting times, implying a stronger relation between waiting times and satisfaction. We therefore suggest a moderating role of SST use on the perceived waiting time-satisfaction relationship:

*H 11: The relationship between perceived waiting time and satisfaction will be higher for users of SST than for non-users.*

## EMPIRICAL STUDY

### Data collection

Six teams of interviewers simultaneously collected data in six stores of a retailer chain in Western Europe. All stores offered the choice of either using or not using self scanners. Data were collected during a three day period to ensure a representative cross-section of shoppers. Data collection consisted of two stages. In the first stage, interviewers addressed shoppers upon entering the store. A questionnaire with closed-end questions was used for this interview, which took place at the entrance, between the store shelves and the self-scanning devices. The next stage of data collection was after the customers had done their shopping and had checked out their items. They were requested to participate in an exit survey. A questionnaire with closed-end questions was then administered to the respondents. The exit interviews took place between the cash register and the exit of the store.

***Survey Administering***

The entry survey contained two filter questions to ensure that we did not include people who were unaware of self-scanning devices. The second question was asked to ensure that only customers with a loyalty card filled out our survey. This was due to a policy of the store that insisted on offering self-scanning devices only to loyal customers. Consequently, only loyal customers take part in this research and thus the variable loyalty is held constant. Upon provision of acceptable responses for the filter questions, the main questionnaire was administered to the respondents. The questionnaire consisted of a series of Likert items measuring the perceived attributes of the SST as well as attitudes towards the SST. In addition, demographic variables including educational level, year of birth and gender were also measured. Participants were assigned unique identification numbers to enable us to match their responses before and after their shopping experience. An accomplice also recorded participants' usage of self scanners, as well as the number of SST users present (operationalised as the number of SST devices taken), and the number of non SST users waiting at the cash registers (as a proxy for number of non SST users present).

At the end of the shopping experience, the identification numbers of the participants were recorded to enable us to match their responses at entry and exit. Participants' actual use of self-scanners was again observed and coded. Respondents then answered additional questions about their perceptions of how long they waited in line and about their levels of satisfaction with the shopping experience.

**Measures**

Attitudes were measured using a three item five-point semantic-differential scale. Perceived attributes of the SST were measured by means of five point Likert scales based on Dabholkar (1994), Dabholkar and Bagozzi (2002) and own qualitative interviews with customers. Perceived ease of use embraced two items capturing aspects related to user-friendliness and effort related to using self-scanning. Perceived usefulness was assessed by three items capturing efficiency, speed of shopping with self-scanning and SST use effect on waiting time at the cash register. Reliability/fulfillment was quantified with three items capturing the extent to which self-scanning is expected to work well and have a faultless result. Perceived fun was employed by two items capturing to what extent the use of self-scanning is perceived as being entertaining and enjoyable. Perceived newness was measured

using three 5-point semantic differentials. Items of all attitudinal and attribute variables are presented in the appendix.

Use of self-scanning was observed and notated as a dummy variable, with 0 equaling no use of self-scanning and equaling use of self-scanning. The exit interviewer double-checked the observation of the entry interviewer. If the two observations did not match, the case was not included in the analyses.

Age was measured by asking respondents' year of birth and subtracting it from the year of data collection. Sex was observed and notated as a dichotomous variables where 1 equals male and 2 equals female. Level of education was measured by means of an open question and then dichotimized into lower versus higher education (secondary school or less or more then secondary school respectively).

Satisfaction with the shopping trip was captured on a scale from zero to ten, where zero is very dissatisfied and ten is very satisfied. Perceived waiting time was measured as the perception of how many minutes the respondent had been waiting at the cash register (Hornik 1984). We consciously used single item measures in the exit survey in order to limit the burden on our respondents. This way, we intended to minimize non-response to the exit survey as well as bias due to irritation. Other researchers have made the same choice in a similar context (Taylor 1994) and perceived waiting time can be argued to be measurable by a one-item measure (Rossiter 2002).

## RESULTS

### Sample

1492 shoppers were approached to participate in the survey. 709 people responded favorably to participate, giving us a response rate of 47.1 percent. Only 632 respondents who answered favorably possessed a loyalty card and this number dropped to 610 when we factored in participant's familiarity with self-scanning devices. Each respondent was issued a ticket with a unique identification number and this ticket was then collected by a second team of interviewers awaiting respondents at the exit of the store. Of the 610 respondents, 554 people (90.8 percent of entry participants) participated in the exit survey. Out of these 554 responses at the exit, 548 responses could be matched with the same customer's response at the entry. In the end, 492 questionnaires contained complete data and could be used for further analysis. In this sample, 64.4 percent (35.6 percent) were female (male). 60.6 percent (39.2 percent) had had education after secondary school (1 persons data were missing on this

variable). 1.3 percent were aged 12-19, 21.2 percent 20-29, 21.5 percent 30-39, 27.9 percent 40-49, 18.2 percent 50-59, 7.5 percent 60-69, 1.5 percent 70-79, and .9 percent 80-89 years. 35.4 percent used self-scanning during the current visit to the store.

**Data Analysis**

To test our main attitudinal model as represented in pane I of Figure 1, we specify a structural equation model. We test the model and estimate the parameters applying the MPlus software version 3.13, using the WLSMV estimator, a robust weighted least squares estimator. This allows us to treat the indicators of the beliefs and attitude indicators as ordered categorical (ordinal) variables. These items are rated on five point scales and are not normally distributed. Moreover, the dependent variable used is an observed (non-latent) binary variable. The model therefore includes a probit regression of SST use on attitude towards SST.

We first tested the measurement model, not including use, since it is an observed variable, allowing for covariances between all constructs. This confirmatory factor analysis resulted in acceptable fit indices ($chi^2(38)=99.92$; $p<.001$ SRMR=0.042; TLI=0.995; CFI=0.991; RMSEA=0.061) indicating convergent validity. Composite reliabilities for the constructs ranged from 0.75 to 0.98. Correlations between constructs range from .19 through .56.

***Test of core model***

We simultaneously test all relations in our core model (i.e. without moderating effects). Model fit is acceptable ($chi^2(46)=115.38$, $p<.001$; SRMR=.042; TLI=.995; CFI=.990; RMSEA=.058). Table 1 summarizes the standardized regression weights. It is clearly evident from the table that users' attitudes towards the SST is significantly affected ($p<0.05$) by the ease-of-use of the technology, the perceived usefulness of the SST, the reliability of the technology, and the fun associated with using the SST. Thus, hypotheses H1 through H4 were supported. Additionally, our results indicate that user attitudes towards SST positively and significantly affected the actual use of self-scanning technology ($p<0.001$), thereby supporting H5.

Insert Table 1 About Here

***Test of moderating effects***

Next, we study the moderating effect of three demographic variables (age, education level, gender). Education level and gender were measured as binary variables. To obtain comparable results across our moderating variables, we also transformed age into a binary grouping variable by means of a median split. For each moderator separately, we first estimate a model that constrains all regression weights to equality across groups. In this model (model A), we assess whether or not the link between use and attitude has a significant modification index (M.I.). Next, we estimate a model in which the attitude-use link is released if necessary (model B). In model B, we assess the modification indices of the regression weights between attitude and the perceived attributes. Finally, we release the equality constraint for the regression weights that have M.I.'s higher than 3.84 (corresponding to $p<.05$) and evaluate whether the between-group parameter difference is substantial (at least .05; cfr. Dabholkar and Bagozzi 2002). This results in the final model. Table 2 presents the regression weights in the final (partially moderated) model, as well as the M.I.'s as they were in the fully constrained (non-moderated) model for the non-reference group. Table 3 summarizes the fit indices for the constrained (non-moderated) and the final (partially moderated) model for each moderator variable. Note that one cannot apply simple $chi^2$ difference tests to these results, since we used the WLSMV estimator.

Insert Table 2 About Here

A review of the results in table 2 indicates that the level of education did not significantly moderate the relationship between perceived usefulness and attitude. Higher levels of education did positively influence the newness-attitude relationship: for customers with lower education levels, newness is negatively related to attitude ($p<0.05$; one-sided test). For customers with higher education levels, the effect is non-significantly positive.

Insert Table 3 About Here

It is evident from table 2 that there is no significant effect of age on the relationship between the newness of the SST and the attitude towards the same. However, age does show some impact on the attitude-use relationship. Our results indicate that the attitudes of younger customers towards SST is more likely to result in actual usage of technology ($b=0.83$,

p<0.001) than for older people (b=0.80, p<0.001). The difference between the groups is very small, however. This indicates that H7 was partially supported.

Our results also indicate that the relationship between perceived usefulness and attitude towards the SST is stronger for males (b=0.38; p<0.01) than for females (b=0.29; p<0.05), thus supporting H8.

***Outcomes of SST Usage***

To explore the impact of SST use on shopping outcomes, we specify a means and covariances path model as presented in figure 1, pane III. Parameters and model fit indices are estimated in AMOS version 5, using the Maximum Likelihood estimator. Use versus non-use of SST is used as a grouping variable. Such model allows us to compare the means of the variables in the model, as well as the relationships between them. The focus is on perceived waiting time and satisfaction. Additionally, we took into account the following control variables: the number of products the customer plans to purchase on entering the store, the number of products actually purchased, the number of SST users, and the number of non-SST users present during shopping. In our model, the number of SST users and non-SST users were considered as antecedents of perceived waiting time and satisfaction and are related with one another.

First, we freely estimate all structural intercepts (i.e. the means of the endogenous variables, controlling for the exogenous variables) and all structural regression weights. This is the unconstrained base model. The fit of this model is good (see fit indices in table 4). In the next model, we constrain all the structural regression weights and intercepts to equality across groups. As can be read from table 4, this leads to a significant deterioration of fit, indicating that the outcomes model has different parameter values for users and non-users. Next, we free the parameters that show significant M.I.'s (> 3.84; p<.05). These parameters are the intercept of perceived waiting time, and the regression weights between perceived waiting time and satisfaction, between number of SST users and perceived waiting time, and between number of non-users and perceived waiting time. This model again shows good fit. In table 5, we report respectively the regression weights and the intercepts of the variables in the outcomes model.

Insert Table 4 & 5 About Here

Our results indicate that users of SST do perceive that they have to wait less when compared to non-users, though the difference is small. Thus H9 was supported. Similarly, our data analysis yielded a significant negative effect of perceived waiting time on the level of satisfaction experienced, thus supporting H10. In line with hypothesis 11, his difference is stronger among users of SST ($b=-0.346$; $p<0.05$) as compared to non-users ($b=-0.304$; $p<0.05$). Some further interesting findings are that for SST users, perceived waiting time is less strongly determined by its antecedents: number of products purchased, number of SST users and number of SST non-users. For SST non-users, perceived waiting time is positively influenced by number of products purchased and number of SST non-users, and negatively influenced by number of SST users.

## DISCUSSION

In this paper, we propose a process model of SST usage by customers in a retail setting. We set out to replicate the findings of Dabholkar and Bagozzi (2002) and to build on previous research by (a) focusing on the moderating role of demographic variables on some key relationships in our process model and (b) focusing on the outcomes associated with SST usage. In the model, perceived attributes of the SST are related to attitude towards using the SST. The following attributes were taken into account: (1) perceived ease of use, (2) perceived usefulness, (3) fun associated with using the SST, (4) reliability, and (5) newness. While we did not study the main effects of newness of SST on the attitudes of customers towards SST, this relationship was considered when we tried to account for the moderating effect of demographics on the model. We differ from Dabholkar and Bagozzi (2002) by studying the effect of attitude towards SST on the actual use of the SST. Subsequently, using the SST affects the perception of waiting time at the cash register, which in turn, is an important antecedent of customer satisfaction with the shopping trip.

Our results demonstrated that - respectively - perceived usefulness, ease of use and fun had the strongest impact on attitude towards the SST. While most of the findings from previous research were replicated, the effect of reliability on attitude was not significant. This result is in contrast to the findings by Dabholkar and Bagozzi (2002). Interestingly, our results also indicate that perceived usefulness demonstrates the highest explanatory power on attitude. We think that this is interesting considering the fact that Dabholkar and Bagozzi (2002) did not include this variable and we suggest that our results may be due to the context of a real life retail setting in which our study took place. The role of perceived usefulness of

technology has been demonstrated in real life settings before and our results are in keeping with these results (Davis 1989; Venkatesh and Davis 2000). Hence, we believe that further research on adoption behavior of SST must also account for the effects of perceived usefulness associated by users with the technology.

A major contribution of our study is the extension of previous research by focusing on not only actual usage of SST by customers, but also on the corresponding outcomes associated with using the SST. Our results indicate that the attitude towards using the SST is a significant predictor of actual usage. While this finding is not surprising, to the best of our knowledge, not a lot of studies exist that have actually focused on this relationship. Further, we think that it is interesting that people who actually use SST are more likely to have lower perceptions of waiting time. Together with our finding that the perception of waiting time significantly effects the satisfaction associated with the shopping experience, this indicates the importance of getting customers to try and use SST. When customers use self-scanning devices, they are likely to perceive that they spend less time in line, waiting to complete their shopping experience and as a result are more likely to be satisfied with the whole shopping experience. It is important to fulfill the promise of faster check-out, especially given the stronger impact of perceived waiting time on satisfaction among users of SST.

Another main contribution of our study is the focus on the moderating effects of demographic variables on the previously described base model. Our findings indicate that demographic variables do seem to affect some of the relationships in the main process model. While research on the use of technology in organizations has focused on the role of demographic variables (Morris and Venkatesh 2000; Venkatesh and Morris 2000), in the domain of SST acceptance, research still remains limited. Our study serves to highlight a key role played by education, age, and gender of the customers. Our results indicate that age, education level, and gender of an individual customer affects the extent to which they evaluate certain features of the technology. A review of these results indicates that retailers should take into account diverse demographic profiles of their customers when trying to increase SST use.

Additionally, perceived newness has an opposite effect among the two eductional groups: among lower educated people it is negatively related to attitude, among higher educated customers it is non-significantly but slightly positively related to attitude. As hypothesized, more educated customers are likely to appreciate the innovativeness of the technology, while lowly educated customers might rather avoid novelty of such technologies. We did not find a significant effect of education on the perceived usefulness-attitude relationship.

Research in an organizational setting has found that age moderates the process leading to adoption of technology. While Morris and Venkatesh (2000) show the attitude-intention relation is stronger among younger people than older people, in our study we actually compare younger and older respondents in terms of the attitude-behavior link. However, in keeping with Morris and Venkatesh (2000), our results do indicate that the relationship between attitude towards SST and the subsequent usage depends on the age of the users. However, while we expected the newness of the technology to more positively affect attitudes amongst younger customers than for older customers, we did not find support for this hypothesis.

Additionally, we do find support for the differences between men and women on the relationship between perceived usefulness and attitude towards the SST. In our study, the link between perceived usefulness and attitude is stronger for men than for women. This finding is in keeping with Venkatesh and Morris (2000), who suggest that men are more likely to focus on the benefits from using the technology, than women who are more likely to be interested in making sure that the technology does not hinder their shopping experience.

## LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

While this study has provided us with a deeper insight in the process of customer interaction with SSTs, a number of limitations still remain. Together with the findings discussed above, these limitations may indicate routes for future research. In this study, perceived waiting time and overall satisfaction were measured using only one item. Multiple items per construct generally are accepted as the ideal or, in some cases, required methodology (Churchill 1979). We made a trade-off in favor of minimizing irritation among our respondents, thus also decreasing the risk of reactivity of measurement (Taylor 1994).

Our study is cross-sectional and is limited to what happens during one shopping trip. Needless to say, the attitude formation process extends to the period both before and after the

shopping trip. Previous experience will definitely influence the beliefs, attitude and intention of some customers or will do so in the future. Although past behavior has been proven to be a sound predictor of current behavior (Sheeran, Orbell, and Trafimow 1999), we believe the route we have taken in this study is more insightful in face of the questions at hand. More specifically, we wanted to establish customer perceptions of SST attributes and their corresponding relationship to attitudes and actual SST use. We did this for different demographic groups and were interested in the outcomes of SST usage across these demographic groups. Splitting out different groups of light to heavy users, e.g., would seriously impede the analytical and statistical possibilities of this study, without substantially improving its added value.

An important part of our model is measured by means of one questionnaire at one point in time. This might have led to common method bias. Several arguments can be made against this possibility. First, we observed regression weights of zero where expected (for the main effect of novelty on attitude). This supports the claim that factors in our model were not spuriously correlated as a consequence of yeah-saying. Also, the relations between variables that are measured at different stages of our data collection (entry survey – observation – exit survey) show effect sizes in the same range as those of the other relations.

## APPENDIX

Below, we list the items used in the entry survey to measure perceived SST attributes and attitude towards using the SST. Standardized factor loadings for each item are given between brackets.

**Attitude**

How would you describe your feelings towards using self-scanning technology in this store? (Five-point semantic differential scales)

(1) unfavorable-favorable (.94)

(2) I dislike it – I like it (.96)

(3) Bad-good (.94)

**Ease of use** (Five point Likert scale: Completely Disagree-Completely Agree)

Self-scanning will be effortless (.81)

Self-scanning will be user-friendly (.97)

**Newness** (Five-point semantic differential scales)

Self-scanning is outmoded- Self-scanning is progressive (.87)

Self-scanning is old - Self-scanning is new (.79)

Self-scanning is obsolete - Self-scanning is innovative (.88)

**Reliability** (Five point Likert scale: Completely Disagree-Completely Agree)

Self-scanning will be reliable (.75)

I expect self-scanning to work well (.85)

Self-scanning will have a faultless result (.74)

**Fun** (Five point Likert scale: Completely Disagree-Completely Agree)

Self-scanning will be entertaining (.90)

Self-scanning will be enjoyable (.96)

**Perceived Usefulness** (Five point Likert scale: Completely Disagree-Completely Agree)

Self-scanning will allow me to shop faster (.82)

Self-scanning will make me more efficient while shopping (.84)

Self-scanning reduces the waiting time at the cash register (.68)

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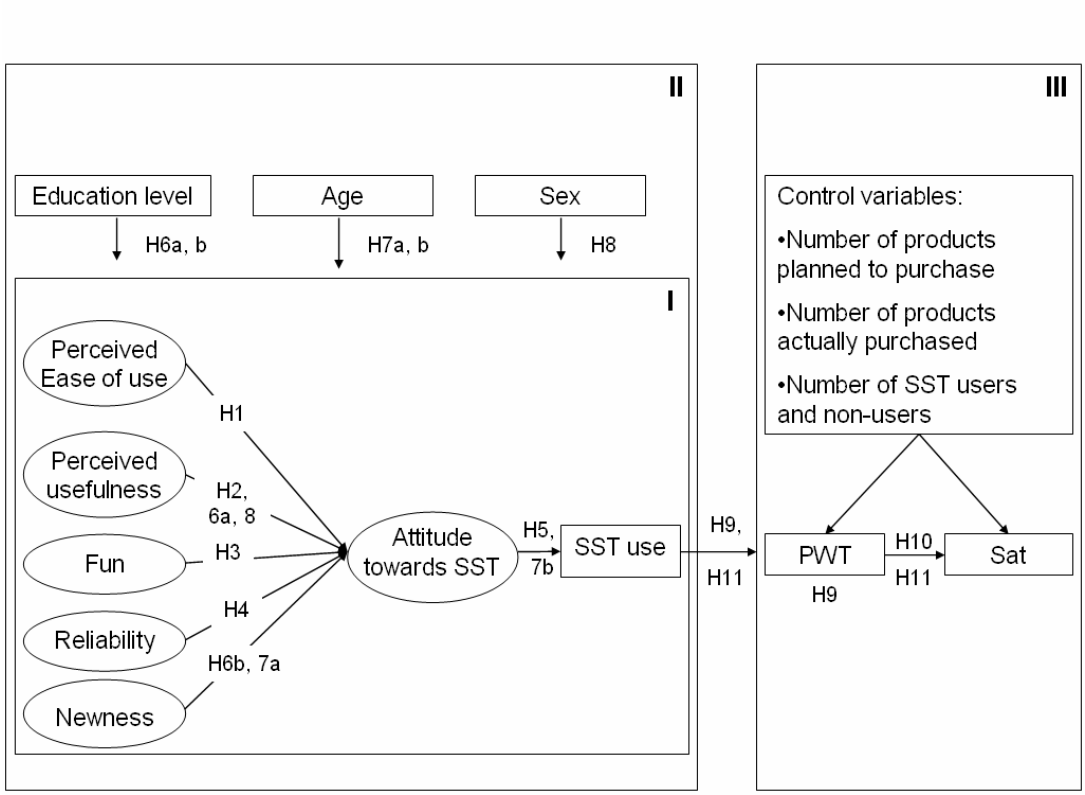
**FIGURE 1**

**Model of SST usage**




PWT = perceived waiting time
Sat = satisfaction with the shopping experience

**TABLE 1**

**Regression weights of the main model (pane I of Figure 1)**

| Dependent variable ($R^2$) | Independent Variable | Standardized regression weight | t-value |
|---|---|---|---|
| Attitude (.635) | Perceived usefulness | .33 | 5.56 |
| | Perceived ease-of-use | .30 | 5.55 |
| | Fun | .24 | 4.80 |
| | Reliability | .17 | 3.57 |
| | Newness | .02 | .38 |
| Use (.644) | Attitude | .80 | 23.70 |

**TABLE 2**

**Regression weights in the partially moderated models (pane II of Figure 1)**

| | | (1) USE on ATT | (2) ATT on PU | PEU | FUN | REL | NEW |
|---|---|---|---|---|---|---|---|
| Age | M.I. | 5.44 | | | 5.42 | | |
| | Young | .83 | | | .16 | | |
| | | (20.08) | | | (2.38) | | |
| | Older | .80 | | | .30 | | |
| | | (9.35) | | | (4.00) | | |
| Education | M.I. | 9.69 | | | 4.23 | 5.04 | 4.06 |
| | Low | .77 | | | .26 | .15 | -.10 |
| | | (13.62) | | | (3.79) | (1.99) | (-1.65) |
| | High | .84 | | | .13 | .03 | .04 |
| | | (8.56) | | | (2.02) | (.42) | (.75) |
| Gender | M.I. | n.s. | 8.26 | | | | 5.92 |
| | M | | .38 | | | | .06 |
| | | | (5.07) | | | | (1.02) |
| | F | | .29 | | | | -.01 |
| | | | (3.46) | | | | (-.19) |

(1) M.I. based on model A; standardized regression coefficients (and corresponding t-values) based on final model

(2) M.I.'s based on model B; standardized regression coefficients (corresponding t-values) based on final model

**TABLE 3**

**Fit indices for the moderated model (pane II of Figure 1)**

| Moderator | Model | chi² | df | p | NPAR | CFI | TLI | RMSEA | WRMR |
|---|---|---|---|---|---|---|---|---|---|
| Age | Model A | 170.904 | 88 | <.0001 | 136 | .988 | .994 | .065 | 1.128 |
| | Model B | 172.891 | 89 | <.0001 | 137 | .988 | .994 | .065 | 1.116 |
| | Model C | 172.073 | 89 | <.0001 | 138 | .988 | .994 | .065 | 1.104 |
| Edu | Model A | 148.318 | 86 | <.0001 | 136 | .993 | .996 | .057 | 1.056 |
| | Model B | 146.901 | 87 | .0001 | 137 | .994 | .997 | .056 | 1.033 |
| | Model C | 140.970 | 86 | .0001 | 140 | .994 | .997 | .054 | .997 |
| Gender | Model A | 135.849 | 85 | .0004 | 136 | .993 | .996 | .052 | 1.019 |
| | Model C | 135.503 | 86 | .0005 | 138 | .993 | 996 | .051 | .995 |

**TABLE 4**

**Model fit indices of outcomes path model (pane III of Figure 1)**

| Model | NPAR | CMIN | DF | P |
|---|---|---|---|---|
| Unconstrained | 44 | 13,925 | 10 | 0,176 |
| full invariance | 34 | 59,103 | 20 | 0,000 |
| final model | 39 | 22,612 | 15 | 0,093 |

**TABLE 5**

**Regression weights and intercepts of the outcomes path model (pane III of figure 1)**

| | | | | Non-SST users | | | | | SST users | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Regression weights | DV | | IV | Stdd b | Unstdd coeff | S.E. | C.R. | P | Stdd b | Unstdd coeff | S.E. | C.R. | P |
| | PWT | on | N_BUY | 0,13 | 0,02 | 0,01 | 2,35 | 0,019 | -0,08 | -0,01 | 0,01 | -1,10 | 0,270 |
| | PWT | on | N_USE | -0,14 | -0,05 | 0,02 | -2,05 | 0,040 | -0,08 | -0,02 | 0,02 | -0,90 | 0,371 |
| | PWT | on | N_NONUSE | 0,35 | 0,08 | 0,01 | 5,40 | < ,001 | 0,30 | 0,04 | 0,01 | 3,38 | <,001 |
| | SAT | on | PWT | -0,30 | -0,13 | 0,02 | -5,73 | < ,001 | -0,35 | -0,21 | 0,04 | -5,34 | <,001 |
| Intercept | PWT | | | | 1,32 | 0,41 | 3,23 | 0,001 | | 1,28 | 0,44 | 2,89 | 0,004 |

DV = Dependent Variable; IV = Independent Variable;
Stdd b = Standardized regression coefficient; Unstdd coeff = Unstandardized coefficient (regression coefficient or intercept);
S.E. = Standard Error; C.R.= Critical Ratio; PWT = perceived waiting time; N_BUY = number of products purchased; N_USE = number of SST users; N_NONUSE = number of non SST users; SAT = satisfaction