Self-Service and Traditional Check-Outs in a Retail Setting
An Analysis of Perceptual Differences and Satisfaction Drivers

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This study aims to analyse how users of self-service and traditional check-outs perceive their preferred check-out type, and how several perceptual attributes impact satisfaction with the check-out used. The empirical results prove that users of self-scanning perceive this check-out type as faster, more enjoyable, and offering more in terms of tangibles and control compared to perceptions of traditional check-outs by their users. In contrast, there are no perceptual differences regarding ease of use/reliability or responsiveness. However, perceptions of self-scanning users depend on their experience with self-scanning (experienced versus novice users). With regard to check-out satisfaction, speed, ease of use/reliability, enjoyment and responsiveness have a significant impact for at least one check-out type or user group. Furthermore, interaction effects between these attributes can be found and the impact of both attributes and the interactions differ between check-out types and user-groups.

Keywords
self-service, self-scanning, technology, retailing, satisfaction

1. Introduction

New possibilities to increase the quality of service and communication at the point of sale arise from employing innovative information technologies (Chu/Morrison 2003). These new technologies include, e.g., the Personal Shopping Assistant (PSA), intelligent scales, information terminals, biometric finger scans and self-scanning at the cash register, all of which offer self-service options to consumers (EDS/IGD 2006; IBM 2006; KPMG/Indiana University 1999; Metro 2006). However, the availability of these technologies differs between geographical markets. Self-service check-outs were introduced in the US more than twenty years ago (Dabhokar/Bobbitt/Lee 2003). In Europe, however, customers are less familiar with this check-out type. The German Metro, for example, introduced self-service check-outs in 2003 (Kalyanam/Lal/Wolfram 2006; Litfin/Wolfram 2006; Loebbecke 2004). This is somewhat surprising, as self-service check-outs are intuitively an attractive technology for retailers. They allow retailers to deploy fewer personnel at the cash registers and could attract special customer segments which prefer self-service check-outs for reasons of speed and control, and personally enjoy using these fascinating machines. On the other hand, there may be other segments, which prefer traditional check-outs because they value personal interaction with cashiers and believe that these are more easy to use (Loebbecke 2004).
The existence of different technology oriented customer segments is also supported in the literature. A number of studies have illustrated that certain shoppers willingly try new self-service options whilst others assiduously avoid them (Dabholkar/Bobbitt/Lee 2003; Meuter et al. 2005; Simon/Usunier 2007; Timmorn/Rymon 2007; Walker et al. 2002; Walker/Johnson 2006). This implies that retailers must satisfy at least two different customer segments: users and non-users of self-service check-outs. For retailers, it is very important to find out how users of self-service and traditional check-outs perceive their preferred check-out type, and how these perceptions influence satisfaction with the check-out used. Knowledge of the relevant satisfaction drivers in both segments yields specific management implications for self-service and traditional check-outs. In addition, it seems sensible to split the group of self-scanning users into experienced and novice users as perceptions and satisfaction drivers can differ between these two sub-groups.

The presented research attempts to provide a clearer picture of how both traditional and self-services are perceived by their corresponding users and how these perceptions influence customer satisfaction. This is exemplified by the comparison of self-service check-outs and traditional cash registers in stores of a large European retail chain. To identify strengths and weaknesses of the two check-out options, it is necessary to differentiate between perceptual attributes, which prior studies have identified (e.g., Anselmsson 2001; Dabholkar 1996).

The central questions discussed in this paper are as follows:

- For which attributes do the users’ perceptions of self-service and traditional check-outs differ?
- How homogeneous are the users’ perceptions of self-service check-outs? Do they differ between experienced and novice users?
- What are the influences of these attributes on the satisfaction with the chosen check-out? Do these influences differ between check-out types (self-scanning vs. traditional) and user groups (self-scanning experienced vs. novice)?
- Which management and marketing implications for the point of sale can be derived from the results?

2. Conceptual Framework and Literature Review

Several studies have already investigated consumers’ evaluations of and preferences for self-services (Bateson 1985; Bobbitt/Dabholkar 2001; Curran/Meuter 2005; Dabholkar 1996; Dabholkar/Bagozzi 2002; Meuter/Bitter 1998; Meuter et al. 2000; Meuter et al. 2005; Simon/Usunier 2007; Timmorn/Rymon 2007; Walker/Johnson 2006). Only very few studies specifically analysed customer perceptions of self-service check-outs in a retail context (e.g., Anselmsson 2001; Dabholkar/Bobbitt/Lee 2003; Marzocchi/Zammit 2006; Weijters et al. 2007).

In particular the work of Dabholkar (1996) has considerably influenced subsequent studies about how different attributes can impact perceived service quality or satisfaction with self-service check-outs. Dabholkar analysed the perception of using touch screens for meal orders in a fast food restaurant. Based on literature analysis (e.g., Bateson/Hui 1987; Holbrook et al. 1984; Langeard et al. 1981; Ledingham 1984; Parasuraman/Beu/Zeithaml 1988) and a qualitative study, she identified five attributes of technology-based self-service options which were apparently important to potential customers: speed of delivery, ease of use, reliability, enjoyment and control. These attributes can be defined as follows (Dabholkar 1996, pp. 33-35):

- Speed of delivery is defined “as the customer’s expectation of the time it would take to actively perform the service.”
- Ease of use is “the effort required to use” a service option and “the complexity of the process of service delivery.”
- Reliability refers to “customer expectations of how accurately their orders will be fulfilled when they use the technology-based self-service option.”
- Enjoyment arises “intrinsically from interacting with” a service option “or from the novelty aspect.”
- Perceived control is “the amount of control that a customer feels he/she has over the process or outcome.”

Consumer perceptions of self-service check-outs were first investigated by Anselmsson (2001). He analysed the impact of different customer characteristics and perceptual attributes on perceived service quality, preferences for and satisfaction with self-scanning in grocery stores and libraries. For the grocery sample, he interviewed customers of a grocery store relying mainly on self-service check-outs (a single traditional check-out was operated during rush hours only). He found that ease of use had the largest impact on service quality, followed by enjoyment, speed of delivery, and reliability. Control was not identified as a significant predictor of service quality. However, in addition to these five attributes the perception of personnel support also proved to be a significant predictor. Physical appearance had a small but significant effect on perceived service quality. The results for preferences and satisfaction as dependent variables were very similar; however, the impacts of reliability and physical appearance were not significant for both preference and satisfaction. The coefficient for personnel support was significant for satisfaction but not for preference. The additional attributes personnel support and physical appearance were defined by Parasuraman/Berry/Zeithaml (1988, p. 23):
Personnel support is related to the responsiveness dimension in service quality research. Responsiveness is defined as the “willingness to help customers and to provide prompt service”.

Physical appearance is related to the tangibles factor in service quality research. Tangibles comprise “physical facilities, equipment, and appearance of personnel.”

Ansellmsson (2001) also tested differences between the perceptions of self-service and traditional check-outs. He found that self-service check-outs are perceived better for control, enjoyment and physical appearance but worse for ease of use, reliability and personnel support. Surprisingly, there was no difference for speed. However, this may be explained by the fact that the traditional check-out was only operated to accelerate cashing in rush hours.

In a subsequent study, Dabholkar/Bobbitt/Lee (2003) interviewed 49 customers after using a self-service check-out. They measured the perception of the service (speed, control, reliability, ease of use, enjoyment) and the preference for the self-service option over traditional check-outs. Although all perceptual attributes correlate significantly with preference, a multiple regression showed only ease of use to be significant. Additionally, Dabholkar/Bobbitt/Lee (2003) compared attribute perceptions between respondents planning to use self-scanning regularly and those who did not plan to use it (regularly). These results showed that respondents who plan to use self-scanning regularly perceive self-scanning as offering greater control and enjoyment, and as being more reliable and easier to use than the other group of respondents. There were no differences in perception for speed; however, the mean value for speed was higher than the means of all other attribute perceptions. A content analysis demonstrated that the most important factor for liking or using self-scanning is speed. Nevertheless, control, reliability, ease of use and enjoyment were also mentioned. Respondents not liking or using self-scanning especially stated their need for interaction with employees to explain their preferences.

Marzocchi/Zammit (2006) investigated the impact of enjoyment (hedonic orientation to self-scanning), control, responsiveness of personnel and information about self-scanning to explain satisfaction with self-service check-out. They found that enjoyment carried the largest impact, but had collected their data in a store where self-scanning had been introduced recently. Therefore, the novelty of this technology may explain the large impact of enjoyment.

The study by Weijters et al. (2007) is based on the technology acceptance model (Davis 1989). They analyse how perceived usefulness, ease of use, reliability and fun influence the attitude towards self-scanning, and find strong effects for usefulness and ease of use and smaller effects for fun and reliability. Here, the effect for reliability is weak and only significant if tested one-tailed.

Table 1 summarises previous studies on self-service check-outs. In addition to those studies presented in detail in Table 1, a few further studies on self-scanning are available (Antisal/Flint 2005; Antisal/Paige 2006; Litfin/Wolfram 2006). However, these studies apply dimensions other than those suggested by Dabholkar (1996), which form the basis of our research.

All of the documented studies listed in Table 1 have certain strengths and limitations. Ansellmsson (2001) compared the perception of self-service and traditional check-outs for customers of a store that mostly offers self-service check-outs (i.e., most respondents are users of self-scanning by necessity). However, in most retail settings, retailers permanently offer both check-out options to satisfy customers who prefer self-scanning and those who prefer traditional check-outs. Therefore, the present study compares perceptions and identifies satisfaction drivers for both user segments. Ansellmsson’s strength is that his analysis includes many perceptual attributes and different dependent variables (service quality, preference, satisfaction).

The study by Dabholkar/Bobbitt/Lee (2003) focuses on qualitative results. Although the authors investigate reasons for not intending to use self-scanning, they do not explicitly compare the perception and importance of speed, control, reliability, ease of use and enjoyment between self-service and traditional check-outs. They only compare the perception of self-scanning between respondents intending to use self-scanning regularly and those without such intention. This comparison was based on the responses of a mere 49 shoppers.

The limitation of the study by Marzocchi/Zammit (2006) is revealed by the chosen environment for the authors’ investigation of satisfaction drivers (i.e., where self-scanning had been recently introduced). Therefore, their results may be biased and the impact of enjoyment could be overestimated. However, similarly to the present study, these authors also use satisfaction as the dependent variable. As a result, their study contributes to the understanding of satisfaction drivers for inexperienced self-scanning users.

Weijters et al. (2007) use attitude as the dependent variable and base their analysis on data from users and non-users. The authors do not differentiate attribute importance between these two groups and only investigate a selection of attributes suggested by previous studies.

The literature review illustrates that previous research on perceptions of self-service check-outs exists. However, all studies have some limitations, e.g., stores relying mainly on self-scanning (Ansellmsson 2001), small sample size (Dabholkar/Bobbitt/Lee 2003), stores where self-scanning was introduced recently (Marzocchi/Zammit 2006), or mixing answers from users and non-users (Weijters et al. 2007). Our study takes these limitations into account and extends prior research in a number of ways.
Table 1: Overview of related previous studies on self-service check-outs

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<td>Sample</td>
<td>Customers of a grocery store relying mainly on self-service check-outs (n=281)</td>
<td>Shoppers at self-scanners (n=49)</td>
<td>Shoppers who used self-scanning in an Italian supermarket where it was recently introduced (n=353)</td>
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<tr>
<td>Dependent Variable (Grouping Variable)</td>
<td>a. Service Quality</td>
<td>Preference for self-scanning compared to regular check-outs</td>
<td>Intention to use self-scanning regularly (I) vs. no such intention (NI)</td>
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<tr>
<td>Significant Effects (sorted by coefficient size)</td>
<td>Multiple Regression - Personnel Support - Ease of Use - Enjoyment - Speed - Reliability - Physical App.</td>
<td>Multiple Regression - Ease of Use - Enjoyment - Speed - (Discretion)</td>
<td>Multiple Regression - Ease of Use - Personnel Support - Enjoyment - Speed - (In Operation)</td>
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<td>Non-Significant Effects</td>
<td>- Control - Reliability</td>
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<td>Dependent Variable (Grouping Variable)</td>
<td>Preference for self-scanning compared to regular check-outs</td>
<td>Intention to use self-scanning regularly (I) vs. no such intention (NI)</td>
<td>Satisfaction with self-scanning</td>
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<td>Significant Effects (sorted by coefficient size)</td>
<td>Multiple Regression - Ease of Use</td>
<td>t-Tests (larger mean) - Control (I) - Reliability (I) - Ease of Use (I) - Enjoyment (I)</td>
<td>Path-Model - Enjoyment - Control - Responsiveness - Information</td>
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<td>Non-Significant Effects</td>
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Table 1: Overview of related previous studies on self-service check-outs

of different aspects. In the following, four of these aspects are explained in detail:

(1) Our research differentiates between two customer segments, users of self-service check-outs and users of traditional check-outs, as it seems quite likely that these two customer groups exhibit different preferences for paying and checking-out at a retail store. This could also solve the inconsistency or contradiction in research findings which on the one hand argue that provider-client interaction is a central feature of service delivery (Prendergast/Marr 1994) and the continuously increasing number of self-services on the other hand. We assume that users of traditional check-outs do not wish to scan their items themselves while users of the self-scanners appreciate this technology. By offering both traditional and self-service check-outs, also those customers, who have not been fully content with the traditional check-outs, can be satisfied. These shoppers potentially prefer self-scanning: the new service offer creates greater customer value and thus greater customer satisfaction.

(2) In addition, the present study uses satisfaction as a dependent variable. Hence, we are able to identify satisfaction drivers and can analyse the impact of seven different attributes on satisfaction with the respective check-out option directly after usage. Satisfaction is a construct which is defined very differently in literature. Based on existing literature and analysis of customers’ views about the construct, Giese/Cote (2000, p. 15) define satisfaction as “a summary affective response of varying intensity (...) with a time specific point of determination and limited duration” which is “directed toward..."
focal aspects of product acquisition and/or consumption.” This definition is very broad and should be further developed according to the specific research context. In our context, we measure satisfaction with the check-out via an affective response index to the process and outcome of checking-out, which is experienced immediately after the use of the check-out. Consistent with the literature (Oliver 1981), we assume that disconfirmation of expectations plays a role in satisfaction formation. In our study, satisfaction was selected as the dependent variable because satisfaction strongly predicts future intentions and recommendations to others (Sivadas/Baker-Previtt 2000). Our concept of satisfaction differs from the measurement of service quality because the latter construct is “a global judgment, or attitude, relating to the superiority of the service, whereas satisfaction is related to a specific transaction” (Parasuraman/Berry/Zeithaml 1988, p. 16). Other researchers argue that service quality is defined as a belief statement or attribute performance (Olsen 2002, p. 241) or that overall service quality is an antecedent of satisfaction (Lin/Hsieh 2006; Spreng/Mackoy 1996). Thus, satisfaction should have a stronger link to preferences, intentions and behaviour. We also choose satisfaction instead of preferences because this study does not aim to explain check-out choice. Some prior studies also analysed satisfaction as a dependent variable (Ansellmsson 2001; Marzocchi/Zammit 2006). However, their results may be biased by the specific situational context.

(3) Previous studies analysed the importance of the different attributes in various situational contexts, which could have an impact on the results. Ansellmsson (2001) analysed a store relying mainly on self-service check-outs. However, most retailers who introduced self-scanning tend to offer it as an additional option side by side with traditional check-outs (Litfin/Wolfram 2006; Loebbecke 2004). Marzocchi/Zammit (2006) analysed the perception of self-scanning in a supermarket where self-scanning was introduced shortly before the study was conducted. This may explain the strong effect of enjoyment on check-out satisfaction. The present study will test for this novelty effect by splitting the self-scanning users into those who are experienced with self-scanning and those using self-scanning the first time.

(4) Previous studies have not analysed any interaction effects between the various check-out attributes. Such interactions can contribute to the explanation of satisfaction with the check-out used. Hence, this study will also explore possible interaction effects.

In summary, we extend prior research by (1) comparing the perception of different check-out types by their users, (2) analysing the relative impact of a number of perceptual attributes on satisfaction, (3) splitting self-scanning users into experienced and novice users and (4) identifying interactions between certain perceptual attributes. Our work focuses on the perception of different attributes and their impact on satisfaction with the check-out used (direct and interaction effects). We analyse user perceptions only, and differentiate between experienced and novice users of self-scanning. Thus, our results should indicate which attributes are important satisfaction drivers for three segments: users of traditional check-outs, experienced self-scanning users and inexperienced self-scanning users.

3. Hypotheses

In the following section, hypotheses about perceptual differences between self-service and traditional check-outs and potential satisfaction drivers are developed. By comparing the self-scanner perceptions of shoppers who used self-service check-outs and those of customers who used traditional check-outs, we can verify that both check-out types satisfy different customer needs. Faster execution of the respective service was identified as a central determinant of the self-service choice in general (Bateson 1985) and self-scanning in particular (Ansellmsson 2001; Dabholkar/Bobbitt/Lee 2003). Earlier research has also shown that self-service users perceive increased control in using these options (Bateson 1985; Hoffman/Novak 1996). However, while reliability is also seen as a central determinant of consumer acceptance of new technologies (Belanger/Collins/Cheney 2001; Watad/Disanzo 2000) and service quality (Parasuraman/Berry/Zeithaml 1988), new technologies are often unreliable due to their technical immaturity (Barki/Rivard/Talbot 1993; Schmidt et al. 2001; Scott 2004). Hence, we assume that self-scanning is perceived less reliable by its users. As it takes time to learn how to use a new technology (Moore/Benbasat 1991; Rogers 1995), adopters may perceive it as less easy to use, although ease of use is an important aspect for using a self-service option (Ansellmsson 2001; Childers et al. 2001). The novelty aspect of self-scanning as opposed to the common traditional check-outs causes the former to be perceived as more enjoyable (Ansellmsson 2001). The retailer in this study has store personnel especially trained for supporting shoppers at the self-service check-outs. Normally, one clerk is responsible for supervising four self-service check-out lanes (Grant 2001). Therefore, we can assume that shoppers at the self-scanners perceive this check-out type as more responsive to their needs due to both the specialised personnel and the instant feedback systems integrated in the check-out software, such as on screen help-options and step-by-step instructions. In addition, as the self-service check-outs are a relatively new addition to the retail outlet, their physical appearance is both new and high-tech. Hence, consumers perceive them as offering more than traditional check-outs in terms of tangibles, i.e., the physical appearance of the self-service check-out facilities and equipment as defined by Parasuraman/Berry/Zeithaml (1988).
Hence, we state the following hypotheses:

**Hypothesis 1:** Self-service check-outs are perceived as (a) faster, (b) offering greater control, (c) less reliable, (d) less easy to use, (e) more enjoyable, (f) more responsive (personnel supported), and as (g) offering more in terms of tangibles by their users than traditional check-outs are perceived by their respective users.

However, the group of self-scanning users may not be homogenous in their perceptions. Experienced users of self-scanning could perceive this check-out type differently from customers using self-scanning for the first time. It seems plausible that novice users should learn how to use self-scanners first. Thus, experienced users may perceive self-scanning as speedier and easier to use due to their experience. All the while, novice users could perceive the self-service check-outs as more enjoyable since they experience it for the first time. However, as difficulties in the check-out process can mask this effect, the difference in enjoyment between both groups may be weak. Therefore, we only include speed and ease of use in the second hypothesis:

**Hypothesis 2:** Self-service check-outs are perceived by experienced users as (a) faster, and (b) easier to use, by experienced users than by novice users.

Furthermore, based on our literature analysis, we assume that these seven attributes also influence the consumer’s satisfaction with the respective check-out. Possibly, the importance of the attributes differs between both check-out types (traditional vs. self-service) and user groups (experienced vs. novice). Enjoyment could be especially important for first-time users of self-service check-outs (Marzocchi/Zammit 2006). More experienced users could put more emphasis on performance attributes like speed and ease of use than on enjoyment. The same may hold true for traditional check-outs. However, as it would be possible to generate multiple, diverse assumptions about the relative impact of the seven attributes for the different check-outs and user groups, the analysis of these effects will be exploratory. Therefore, we suggest only a very general Hypothesis, assuming that all attributes have a positive impact on satisfaction. Hypothesis 3 captures this relationship:

**Hypothesis 3:** The attributes (a) speed, (b) control, (c) reliability, (d) ease of use, (e) enjoyment, (f) responsiveness, and (g) tangibles positively influence customer satisfaction with the used check-out.

Finally, we expect interactions between some of the check-out attributes. We anticipate an interaction between ease of use and responsiveness. Responsiveness should become more relevant if problems occur whilst the check-out is used (low ease of use). Hence, the interaction between ease of use and responsiveness should be negative. In addition, ease of use may also interact with enjoyment. If problems in using the check-out occur, this could reduce the relevance of enjoyment on satisfaction. Conversely, if the check-out is easy to use, the relevance of enjoyment can increase. Therefore, the interaction between ease of use and enjoyment should have a positive effect on satisfaction.

**Hypothesis 4:**
(a) The interaction between ease of use and responsiveness has a negative effect on satisfaction with the check-out used.
(b) The interaction between ease of use and enjoyment has a positive effect on satisfaction with the check-out used.

4. Methodology

Our empirical study explicitly examines the consumer perceptions of self-service vs. traditional check-outs and their impact on satisfaction with the respective check-out used. The questionnaires for users of traditional and self-service check-outs were largely identical. We measured the perceptions of the seven attributes defined above and the satisfaction with the check-out used. The questionnaires also contained scales for other variables which are not analysed in this paper. The seven attributes speed, control, reliability, ease of use, enjoyment, responsiveness, and tangibles were measured with three and satisfaction was measured with four items (see Appendix A). The scales for the attribute perceptions were developed based on prior empirical research (Anselmsson 2001; Dabholkar 1996; Dabholkar/Bobbit/Lee 2003; Parasuraman/Berry/Zeithaml 1988). However, the existing scales had to be adopted due to special survey requirements (e.g., a limited number of items per attribute or translation issues) and the results of a pre-test. The satisfaction scale was developed to account for the different aspects of the construct according to our definition. It is also partly based on prior research (Devaraj/Fan/Kohli 2002). All items where measured on a 7-point rating scale ranging from strongly disagree (1) to strongly agree (7).

4.2. Sample description

There were 614 respondents from all ages, incomes and educational backgrounds. 322 used the traditional and 292 the self-service check-outs. 38 of the self-scanning users used the self-service check-outs for the first time. An overview of the socio-demographic structure of the sample, differentiated between users of traditional and self-service check-outs, is depicted in Appendix B. Most respondents are between 20 and 29 years old, resulting in...
a rather young average age of 32 years. The sample consists of approximately 44% female and 56% male participants. The majority of respondents are (university) students (41%) or full-time employed (27%). The large share of university students results from the fact that the examined store was located in a medium sized town with a large university.

5. Results

Prior to testing the hypotheses, we investigate convergent and discriminant validity of the used scales.

5.1. Convergent and discriminant validity

The attributes speed, control, reliability, ease of use, enjoyment, responsiveness, and tangibles were measured with three items each. Satisfaction was measured with four items. Coefficient alpha (Cronbach 1951) ranged between 0.66 for responsiveness and 0.91 for satisfaction. Hence, all alpha coefficients are close to or above 0.7, indicating a sufficient amount of convergent validity (Nunnally/Bernstein 1994).

Discriminant validity was analysed with exploratory and confirmatory factor analyses. In the first step, we conducted an exploratory factor analysis to investigate if the seven check-out attributes are separable from each other. Contrary to our assumptions, the analysis yielded only six factors, explaining 56.9 percent of the item variance. The factors are clearly interpretable as speed, control, enjoyment, responsiveness and tangibles. As a consequence, we decided to combine ease of use and reliability to one factor (ease of use/reliability, denoted in tables as EoU/Reliability). Hypotheses 1 and 3 are corrected accordingly.

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Hypothesis 1 are accepted. The sum-scores for ease of use/reliability and responsiveness are slightly higher for traditional check-outs, but the differences are not significant. Therefore, the hypothesis parts (c/d) and (f) cannot be accepted.

5.3. Perceptual differences of self-service check-outs between experienced and novice users

Hypothesis 2 assumed that experienced users perceive self-service check-outs as (a) faster and (b) easier to use compared to novice users. Table 4 presents the mean differences between both user groups for all attributes. Supporting parts (a) and (b) of Hypothesis 2, the perceptions speed and ease of use/reliability differ significantly, being more favoured by the experienced group. The experienced users also perceive control, enjoyment and responsiveness better than the novice users, but the differences are not significant. The perception of tangibles is identical in both groups.

5.4. The impact of check-out perception on satisfaction with the check-out

Hypothesis 3 assumes that (a) speed, (b) control, (c/d) ease of use/reliability, (e) enjoyment, (f) responsiveness, and (g) tangibles have a positive impact on satisfaction with the check-out used. We tested this hypothesis separately for traditional check-outs perceived by their users, self-service check-outs perceived by experienced users and self-service check-outs perceived by novice users. As the third group is too small to conduct a covariance structure analysis, the results are calculated by separate regressions based on sum-scores. We did not observe any violation of regression assumptions. According to the central limit theorem, normality is not critical as the sample size is sufficiently large, and variance inflation factors were all below the critical value of five (Studenmund 2006, p. 259). We found no indications for non-linearity or heteroscedasticity.

Since preliminary analyses of the data indicated that control and tangibles have no significant impact on satisfaction, the number of independent variables was reduced to four: speed, ease of use/reliability, enjoyment and responsiveness. The refined model regressed check-out satisfaction on speed, ease of use/reliability, enjoyment and responsiveness. The results are presented in Table 5. The four remaining attributes explain a sufficient amount of variance in all three groups. For the traditional check-out, ease of use/reliability has the strongest impact (0.310), followed by responsiveness (0.275) and speed (0.247). Enjoyment is irrelevant for the satisfaction with traditional check-outs. In addition to the main effects, a significant and negative interaction effect between ease of use/reliability and responsiveness (-0.134) is observable.

For self-service check-outs perceived by experienced users, ease of use/reliability also has the strongest impact (0.316), followed by speed (0.294), responsiveness (0.160) and enjoyment (0.102). In addition, the interac-
tion between ease of use/reliability and enjoyment is significant. Compared to traditional check-outs, the impact of responsiveness is weaker while the coefficient for enjoyment is larger and significant.

The regression results for novice self-service check-out users differ quite exceptionally from the two other groups. Whilst ease of use/reliability again has the strongest impact (0.487), enjoyment is also an important satisfaction driver (0.469). Surprisingly, neither the effects of speed and responsiveness nor the hypothesised interaction effects are significant.

Hence, parts (a), (c/d), (e) and (f) of Hypothesis 3 and parts (a) and (b) of Hypothesis 4 are supported by the data for at least one check-out type or user group. There is no support for parts (b) and (g) of Hypothesis 3.

In summary, the impact of the various check-out attributes differs between check-out types and user groups. This is confirmed by the results of the F-tests presented in the last column of Table 5 for five out of six predictors. The F-values were obtained from a univariate analysis of variance, analysing the impact of main effects and interactions between the three groups (as factors) and the different attributes (as covariates) on satisfaction. We can test if the grouping variable interacts with a particular attribute. If such interactions are significant, the impact of an attribute depends on the grouping variable.

### 6. Discussion of results

The aim of the present study was to analyse the perceptual differences between traditional and self-service check-outs by their respective users and to investigate the impact of the different attributes on satisfaction with the check-out used. The results were intended to shed light on relevant satisfaction drivers for both check-out types.

#### 6.1. Summary of results and consistency with previous studies

The empirical results demonstrate that self-service check-outs are perceived as faster, more enjoyable, more tangible, and as offering greater control compared to how traditional check-outs are perceived. In contrast, there are no significant perceptual differences for ease of use/reliability and responsiveness. However, perceptions of self-service check-out users depend on their experience with this service. Customers using these check-outs for the first time perceive speed and ease of use/reliability worse than experienced users.

With regard to the influence on check-out satisfaction, the factor ease of use/reliability impacts satisfaction with both check-out types most strongly, irrespective of the prior experience with self-service check-outs. The relative importance of speed, enjoyment and responsiveness differs between check-out types and user groups. Control and tangibles seem irrelevant for both types of check-outs, irrespective of prior experience.

It is interesting to discuss the consistency with results from previous studies. Similarly to Anselmsson (2001), we found that self-service check-outs are perceived as more enjoyable, more tangible, and as offering greater control compared to traditional check-outs. However, we also found that self-service check-outs are perceived as speedier while Anselmsson (2001) found no significant difference for this attribute. On the other hand, Anselmsson found that traditional check-outs are perceived easier to use, more reliable and more responsive while we observed no such differences. Thus, in our study, self-service check-outs are perceived relatively better than in Anselmsson’s study. A possible explanation could be that in Anselmsson’s study, customers were forced to use the self-service check-out in the respective store while we asked only respondents who chose the self-service check-out voluntarily.
The impact of the different attributes on satisfaction with the self-service check-out is also supported by previous studies. Prior works also found ease of use to be an important driver of satisfaction (Anselmißen 2001), attitude (Weijters et al. 2007) and the intention to use self-service check-outs (Dabholkar/Bobbit/Lee 2003). Further, coefficients for the impact of control were not significant in most studies (Anselmißen 2001; Dabholkar/Bobbit/Lee 2003). However, reliability also had only a small or insignificant impact (Anselmißen 2001; Dabholkar/Bobbit/Lee 2003; Weijters et al. 2007) in previous studies. We can explain this with collinearity effects: as in our study, reliability correlated considerably with ease of use, and both constructs were not statistically separable from each other. Compared to our results, those by Marzocchi/Zammit (2006) are most interesting. These authors identified enjoyment as the most important satisfaction driver for self-service check-outs. We also found a strong impact of enjoyment for the group of novice users of self-service check-outs. However, for experienced users, enjoyment is a much weaker satisfaction driver. Hence, the results from Marzocchi/Zammit were influenced by the fact that they interviewed customers of a supermarket where self-scanning was introduced recently. This technology was new to these respondents and thus more enjoyable.

6.2. Discussion of single effects and implications for future research

In interpreting these results, we should be aware that perceptual attributes were evaluated by users of the respective check-out type only. We did not measure how users of traditional check-outs perceive the self-service alternative. This provides an explanation why ease of use/reliability has a large impact on satisfaction but, in contrast to our expectations, shows no significant differences in perception for self-service and traditional check-outs. If the combined factor ease of use/reliability considerably influences satisfaction, we can assume that this attribute also has an important impact on check-out choice. This is why we observe that the score-means of ease of use/reliability are close to six on a seven-point scale. Thus, customers evaluate the used check-out as very easy to use/reliable in both scenarios (hence, perceptual differences are not significant). However, perceptual differences occur when self-service check-out users are split into experienced and novice users. The latter perceive ease of use/reliability to be lower as they have to learn how to use the new technology. Future research should investigate the antecedents of perceived ease of use/reliability. Perhaps these differ between check-out types because, for example, the reliability of self-scanners mainly depends on the technology whereas the reliability of traditional check-outs is likely to depend on the check-out personnel.

The results for speed are straightforward. Self-service check-outs are perceived as faster in comparison to traditional check-outs. This is not surprising because retailers communicate speed as a central advantage of self-service check-outs to their customers. However, similarly to ease of use/reliability, predominantly the experienced self-scanning users perceive an advantage in speed, while the speed perception of novice users is even worse compared to that of traditional check-out users. Speed is also an important satisfaction driver, except for inexperienced self-service check-out users. This is easy to explain though, as first-time users may not expect a speedy check-out process. They may be aware that they will need time to become familiar with the new check-outs. In addition, it could be sensible for future research to investigate whether consumers perceive speed differently depending, e.g., on the number of articles purchased or the length of the check-out queues. It could also prove interesting to distinguish between waiting time in the queue and the time used for the check-out process.

The results for enjoyment are also quite remarkable. Self-service check-outs are perceived as more enjoyable in comparison to traditional check-outs, and enjoyment is a significant satisfaction driver for the self-service groups. However, the impact of enjoyment for novice users is much stronger compared to experienced users. As people become accustomed to the new check-out type, the enjoyment effect wears off and more functional aspects like speed influence satisfaction with the check-out.

Responsiveness was an important satisfaction driver for traditional check-outs, while it proved less important for the self-scanning option, in particular for novice users (for the latter, the effect was not even significant). We assume that this is a result of a larger variance of responsiveness at traditional check-outs compared to self-service check-outs. At traditional check-outs, the perceptions of responsiveness can vary between different cashiers. In contrast, assistance personnel at the self-service check-outs are specifically trained to help and assist customers with the new technology. We did not observe any perceptual differences for responsiveness between self-service and traditional check-outs, however. Perhaps, responsiveness is interpreted differently for both check-out types. Some respondents may have interpreted traditional check-outs as responsive in the sense that they have contact to the cashiers, while they see self-scanning as anonymous. Other respondents may rate responsiveness at the traditional check-out as poor because personnel are perceived as unfriendly or unhelpful. Future research should analyse these effects more thoroughly.

We should also discuss the results for the perception of control. Users of traditional and self-service check-outs perceive control very differently; however, control has no impact on satisfaction with the check-out type. Since this result is somewhat surprising, future research could investigate heterogeneity in the importance of control between different customer sub-segments. There is some weak evidence that control-related consumer difference variables may affect the decision to use a self-service...
technology in the literature (Oyedele/Simpson 2007). Perhaps segments attaching great importance to control are only small, resulting in the non-significant regression coefficients observed.

Tangibles had no significant impact on check-out satisfaction, although perception differs between traditional and self-service check-outs. This is consistent with Anselmsson’s (2001) findings. In his study, tangibles had a small but significant effect on service quality but not on satisfaction. However, the perception and impact of tangibles may differ between stores and different types of self-service check-outs. Future research should investigate these effects by analysing different types of self-service check-outs in different environments.

Finally, the interaction effects require further elucidations. For traditional check-outs an interaction between ease of use/reliability and responsiveness had a negative impact on check-out satisfaction. Hence, responsiveness becomes more important if there are problems during the check-out process. Surprisingly, such an effect was not observed for self-service check-outs. Here, we can argue that incidents which require personnel assistance are perceived as embarrassing and dissatisfying, even if the personnel were helpful.

Another interaction effect occurred for experienced users’ perceptions of the self-service check-outs where the interaction between ease of use/reliability and enjoyment had a positive impact on satisfaction. Thus, customers weight their enjoyment about the new technology stronger if the check-out process is easy and without any critical incidents. However, no such interaction was found for the group of novice users. For these, enjoyment of the new technology influences satisfaction irrespective of other attributes.

In addition to the research implications resulting from the discussion of single effects, several other directions for future research should be mentioned. Firstly, future research could investigate more thoroughly why and when customers use different types of check-outs. Models could, for example, integrate personal characteristics or additional situational variables as potential moderators. Examples of such moderators are socio-demographics (Weijters et al. 2007), technology readiness (Lin/Hsieh 2006), queues at the different check-outs, time constraints and the type or the number of products in the shopping basket. Such moderators could also explain the behaviour of customers using both types of check-outs. Secondly, a cross cultural comparison with other countries could yield valuable implications for future research. In particular a comparison between continental Europe and the United States could result in interesting contributions. These regions represent contrasting environments: where the diffusion of self-scanners is in its infancy (Loebbecke 2004) and where customers are more familiar with this technology (Dabholkar/Bobbit/Lee 2003).

6.3. Management implications

The results of this study have a number of implications for retail managers. First, the combined factor ease of use/reliability is an important driver of satisfaction with a check-out. Therefore, retailers should invest in more reliable and easy to use self-service check-outs.

For experienced users of self-service check-outs, speed, responsiveness and enjoyment are also significant satisfaction drivers. However, self-service check-outs are only fast as long as customers with large shopping baskets use traditional check-outs. Therefore, as long as most European retailers only offer a limited number of self-scanners in their stores, customers with large shopping baskets should be encouraged to use traditional check-outs. This prevents long queues at the self-service check-outs.

To increase responsiveness for self-service check-outs, retailers should provide qualified personnel to assist customers using the check-out. Interestingly, this is more important for experienced than for novice self-scanning users. Hence, retailers should provide qualified service personnel not only in the introductory phase of self-scanning. However, this also means that the main benefit of self-scanning may not necessarily lie in the reduction of service personnel.

Enjoyment was a weak satisfaction driver for experienced users of self-scanning, but a very strong satisfaction driver for novice users. Thus, retailers should communicate the fun of self-scanning to customers using the traditional check-outs to initiate switching behaviour. In the long run, however, the self-scanners must offer functional benefits to the customers, especially ease of use/reliability and speed. This is underlined by the positive interaction effect between ease of use/reliability and enjoyment.

For traditional check-outs, in addition to ease of use/reliability, responsiveness and speed are important antecedents of satisfaction. To increase responsiveness, retailers should invest in training their cashiers toward more customer orientation. The interaction effect between ease of use/reliability and responsiveness underlines that helpful assistance is especially important if critical incidents occur. To improve the speed at traditional check-outs requires an adequate amount of personnel at the cash registers, especially during peak hours.

Undoubtedly, all of these management implications require monetary investments by the retailers. Therefore, retail businesses should balance the advantage of increased customer satisfaction against these costs. Future research should try to quantify the monetary benefits of investments in satisfaction drivers.

6.4. Limitations

Finally, some limitations of the study must be mentioned. The first limitation is related to the sample composition.
Students were somewhat overrepresented in the sample. However, the study was conducted in a town with a large university and thus the sample structure represents the structure of the store’s customer base. Secondly, we assumed simple linear relationships between perceptions of attribute performance and satisfaction. However, satisfaction is also a result of expectation disconfirmation. Therefore, future studies could integrate expectations and desire into the analysis. The third limitation may be seen in the fact that we applied a regression with sum-scores instead of a structural equation approach. However, this should be justifiable since we tested for discriminant validity with our model. The subsequent analyses were conducted with regression analyses as the group of inexperienced users was too small for a structural equation model. The final limitation accrues from the fact that we collected our data at one particular retail store.

Appendix

A) Measures for attributes and satisfaction

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
</tr>
</thead>
</table>
| **Speed** | - The use of this check-out cost me a lot of time.*  
- The checkout was very quick.  
- At this check-out I could complete my shopping quickly. |
| **Control** | - At this check-out type, I was responsible for the checking out process.*  
- This check-out gives me control.  
- At this check-out I could control whether I pay the correct articles and the correct price. |
| **Reliability** | - The check-out was accurate.  
- The check-out was reliable.  
- The check-out went smoothly.* |
| **Ease of use** | - This check-out was easy to use.  
- It was easy to pay for my shopping at this check-out.  
- The use of this check-out was difficult.* |
| **Enjoyment** | - I enjoyed using this check-out.  
- It was fun using this check-out.  
- Using this check-out was boring.* |
| **Responsiveness** | - At this check-out the personnel is very helpful.  
- At this check-out customers are always helped quickly.  
- The personnel at this check-out are too occupied to react to customer enquiries.* |
| **Tangibles** | - This check-out conforms to the newest technological standards.*  
- The design of this check-out is pleasing.  
- The check-out is visually appealing. |
| **Satisfaction** | - Overall, I was satisfied with the chosen check-out.  
- I was satisfied with the process of checking-out.  
- The checking-out completely fulfilled my expectations.  
- I was satisfied with this check-out overall. |

Source: developed based on Anselmsson 2001; Dabholkar 1996; Dabholkar/Bobbitt/Lee 2003; Devaraj/Fan/Kohli 2002; Parasuraman/Berry/Zeithaml 1988.

All items used 7-point Likert scales (1 = strongly disagree, 7 = strongly agree).

* This item was eliminated in the scale purification process.
### B) Socio-demographic structure of the consumer sample

<table>
<thead>
<tr>
<th>Age (in years)</th>
<th>Traditional Check-Out (n=322)</th>
<th>Self-Service Check-Out (n=292)</th>
<th>Total (n=614)</th>
</tr>
</thead>
<tbody>
<tr>
<td>up to 19</td>
<td>20</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>20 – 29</td>
<td>169</td>
<td>167</td>
<td>336</td>
</tr>
<tr>
<td>30 – 39</td>
<td>44</td>
<td>50</td>
<td>94</td>
</tr>
<tr>
<td>40 – 49</td>
<td>39</td>
<td>27</td>
<td>66</td>
</tr>
<tr>
<td>50 – 59</td>
<td>29</td>
<td>23</td>
<td>52</td>
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<tr>
<td>60 and above</td>
<td>20</td>
<td>14</td>
<td>34</td>
</tr>
<tr>
<td>n.s.</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>total</td>
<td>322</td>
<td>292</td>
<td>614</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gender</th>
<th>Traditional Check-Out (n=322)</th>
<th>Self-Service Check-Out (n=292)</th>
<th>Total (n=614)</th>
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<tbody>
<tr>
<td>female</td>
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<td>120</td>
<td>270</td>
</tr>
<tr>
<td>male</td>
<td>172</td>
<td>172</td>
<td>344</td>
</tr>
<tr>
<td>total</td>
<td>322</td>
<td>292</td>
<td>614</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vocation</th>
<th>Traditional Check-Out (n=322)</th>
<th>Self-Service Check-Out (n=292)</th>
<th>Total (n=614)</th>
</tr>
</thead>
<tbody>
<tr>
<td>pupil/apprentice</td>
<td>27</td>
<td>15</td>
<td>42</td>
</tr>
<tr>
<td>student</td>
<td>128</td>
<td>123</td>
<td>251</td>
</tr>
<tr>
<td>housewife/husband</td>
<td>15</td>
<td>8</td>
<td>23</td>
</tr>
<tr>
<td>fulltime employed</td>
<td>73</td>
<td>91</td>
<td>164</td>
</tr>
<tr>
<td>part-time employed</td>
<td>35</td>
<td>27</td>
<td>62</td>
</tr>
<tr>
<td>retired</td>
<td>25</td>
<td>10</td>
<td>35</td>
</tr>
<tr>
<td>none of these</td>
<td>18</td>
<td>15</td>
<td>33</td>
</tr>
<tr>
<td>n.s.</td>
<td>1</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>total</td>
<td>322</td>
<td>292</td>
<td>614</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Household Net Income (€)</th>
<th>Traditional Check-Out (n=322)</th>
<th>Self-Service Check-Out (n=292)</th>
<th>Total (n=614)</th>
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<tbody>
<tr>
<td>up to 500</td>
<td>46</td>
<td>29</td>
<td>75</td>
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<tr>
<td>501 – 1,500</td>
<td>108</td>
<td>92</td>
<td>200</td>
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<tr>
<td>1,501 – 2,500</td>
<td>51</td>
<td>60</td>
<td>111</td>
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<tr>
<td>2,501 – 3,500</td>
<td>39</td>
<td>34</td>
<td>73</td>
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<tr>
<td>3,501 and above</td>
<td>19</td>
<td>31</td>
<td>50</td>
</tr>
<tr>
<td>n.s.</td>
<td>59</td>
<td>46</td>
<td>105</td>
</tr>
<tr>
<td>total</td>
<td>322</td>
<td>292</td>
<td>614</td>
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Zielke/Lietke/Toporowski/Boslau, Self-Service and Traditional Check-Outs in a Retail Setting
1. Introduction

The field of marketing decision models emerged about fifty years ago. In the beginning, optimization techniques from the field of Operations Research (OR) were dominant, but soon, the modeling of marketing phenomena and marketing problems became interesting in itself, irrespective of whether they could be solved with a known OR technique. The field of marketing models developed its own identity and became an important academic field (Wierenga 2008b). Somewhat later the term “marketing science” became in vogue, as a close synonym to marketing models. In this current, first decade of the new Millennium, the field of marketing science is in excellent shape with booming journals and exponentially growing numbers of publications. However, a legitimate question can be asked: what is the impact of this growing body-of-knowledge on marketing practice? Does all this work lead to better marketing management decisions? In other words “Was macht die Wissenschaft für die Unternehmenspraxis?” (Simon 2008). One important flow of marketing knowledge to marketing practice goes through marketing education and marketing literature. The newest marketing insights are disseminated through courses, textbooks and other communication channels. But there is another important way of making the results from marketing science useful for marketing practice.

This is through marketing decision support systems. Marketing decision support systems act as a bridge between marketing science and marketing practice. At the start of the marketing models movement, people did not see the need for such a bridge. Marketing models lead to better decision, henceforth practitioners would use them. Unfortunately, it turned out that this did not happen. Already in the early 1970’s, Little observed: “The big problem with management science models is, that managers practically never use them” (Little 1970). Mathematical marketing models, however great their potential, are mostly not in a form that makes them directly suitable for application to marketing problems in practice. They have to be integrated in a decision support system in order to make them work. We can conceive of the model (often combined with an optimization procedure) as the powerful engine of a decision support system, but an engine alone does not take you anywhere. It has to be installed on some platform, integrated with the IT system of the company; it has to be connected to data sources from inside and outside the company and the decision maker should be able to communicate with the model through a user-interface that is easy to use. Such a constellation is called a marketing decision support system, and we come back to this later.

The experience with the application of marketing models in practice is mixed (“the glass is both half-full and half-empty”. Lilien and Rangaswamy 2008), but there are encouraging signs. In 2004 the INFORMS Society on Marketing Science Practice Prize Competition was inaugurated. This competition which is open for implementations of marketing science concepts and methods that have a “significant impact on the performance of the organization”. The list of winners and finalists so far (three of them are from Germany/Austria) contains fifteen impressive applications spread over different areas of marketing, including direct marketing, customer lifetime value, online marketing, marketing mix decisions, forecasting, sales force decisions, sales promotions, product line decisions and advertising (Lilien and Rangaswamy 2008). Considering that it takes a lot of effort and time to get an implementation ready for submission to the Practice Prize, it is safe to assume that these successes are the top of a quickly growing iceberg of marketing science implementations in marketing practice. Another indication of the increasing adoption of marketing science-based applications in marketing is the fact that SIMON, KUCHER & PARTNERS (SKP), a prominent Strategy and Marketing Consultancy headquartered in Bonn, mentions that over recent years they have...
developed and implemented over 300 decision support systems, in a broad range of different industries (Engelke and Simon 2007). Hermann Simon, the Chairman of SKP who has a lot of experience in both marketing academia and marketing practice classifies decision support systems as “hits” under the different approaches in marketing science since 1960 (Simon 2008). Also other companies, for example ZS Associates, have realized impressive numbers of implementations of marketing decision support systems, especially in the field of sales management decisions (Sinha & Zoltners 2001; Zoltners and Sinha 2005). In the area of consumer products, companies like Nielsen, GfK, and IRI are constantly developing and improving marketing information systems that help their clients to get the best decision-relevant information out of their data.

The remainder of this article will start with discussing the concept of marketing management support systems, and in particular deal with one important component of marketing management support systems, i.e. marketing models. Next, we will discuss several developments (see Table 1) which create new opportunities for decision support systems in marketing. We conclude the article with a discussion of the gap between marketing science and marketing practice and how decision support systems can help to bridge this gap.

2. Marketing management support systems and marketing models

In 1966, Kotler introduced the concept of a “Marketing Nerve Centre”, providing marketing managers with “computer programs which will enhance their power to make decisions.” The first of these systems were essentially marketing information systems (Brien and Stafford 1968). At that time, the recently introduced computers in companies produced lots of data, and a systematic approach was needed to make those data available in a way that managers could use them for decision-making. Otherwise, there could be a serious danger of “overabundance of irrelevant information” (Ackoff 1967). About ten years later, Little (1979) introduced the concept of marketing decision support systems. He defined a marketing decision support system (MDSS) as a “coordinated collection of data, systems, tools and techniques with supporting software and hardware by which an organization gathers and interprets relevant information from business and environment and turns it into an environment for marketing action” (p. 11). Little’s concept of an MDSS was much more than a marketing information system. Important elements were models, statistics, and optimization, and the emphasis was on response analysis; for example, how sales respond to promotions. In Little’s view, MDSS were suitable for structured and semi-structured marketing problems, had a quantitative orientation and were data-driven.

Almost two decades later, Wierenga and Van Bruggen (1997) presented a classification of marketing decision support technologies and tools, and used the term “marketing management support systems” to refer to the complete set of marketing decision aids. They define a marketing management support system (MMSS) as “any device combining (1) information technology, (2) analytical capabilities, (3) marketing data, and (4) marketing knowledge, made available to one or more marketing decision makers, with the objective to improve the quality of marketing management” (p. 28). Marketing management support systems is a comprehensive term which encompasses the primarily quantitative, data-driven marketing decision support systems (for structured and semi-structured problem areas), as well as marketing information systems, marketing knowledge-based systems and expert systems, and also technologies that are aimed at supporting marketing decision-making in weakly-structured areas (for example: analogical reasoning-Althuizen and Wierenga 2008).

Closely related to MMSS is the concept of marketing engineering (ME), defined as: “a systematic approach to harness data and knowledge to drive marketing decision making and implementation through a technology-enabled and model-supported interactive decision process” (Lilien, Rangaswamy, and De Bruyn 2007, p 2). ME focuses on the analytical component of MMSS, which still has to be implemented in a (broader) marketing management support system in order to make it accessible for users (decision makers in companies).

Marketing models

From the beginning, marketing models have been a core element of marketing management support systems. They represent the analytical capabilities component of a MMSS (see the components of MMSS mentioned above). A marketing model relates marketing decision variables to the outcomes in the market place (for example sales, market share, profit). A marketing model can be used to find the best decision (optimizing) or to answer so-called “what-if” questions (for example: how will sales respond, if we increase our advertising budget with x percent?). Initially, there was a lot of optimism about marketing models. With marketing models, it seemed, marketing would almost become a scientific activity. Kotler (1971) opens his classical book on marketing models, with the statement: “Marketing operations are one of the last phases of business management to come under scientific scrutiny” (p.1). It looked as if marketing decision making would just become a matter of formulating a marketing problem as a mathematical programming problem, and then solve it with one of the known techniques of Operations Research. But the harsh reality was that the actual application of marketing models to real-life problems in companies remained far below expectations. This has caused a tradition of complaints in the marketing literature, lasting until today: “Maybe there is some level of maturity in the technology, but I cannot see much evidence in the application” (Roberts 2000). Lilien and Rangaswamy (2008) refer to “the gap between realized and actual potential for the application of marketing models”.
In hindsight, for marketers it should not have come as a surprise that the supply of sophisticated marketing models did not automatically generate demand. Marketing models have to be adopted and used by decision-makers in organizations, and marketers are just like other people with their resistance to change and to new ways of doing things. Carlsson and Turban (2002) note that the key issues with decision support systems (DSS) are “people problems”. “People (i) have cognitive constraints in adopting intelligent systems; (ii) do not understand the support they get and disregard it in favor of past experiences; (iii) cannot really handle large amounts of information and knowledge; (iv) are frustrated by theories they do not really understand; and (v) believe they get more support by talking to other people (p. 106). Of course, it is not fair to blame only the marketing decision-makers for not using marketing models. In many cases, the models may just not have been good enough or their advantages were not sufficiently clear to the manager.

Given this state of affairs, it became important to have more insight in the role of these “people issues” and, in general, in the factors that can block and/or stimulate the adoption and use of marketing management support tools. This gave rise to systematic research (cross-section studies, field studies, lab experiments, field experiments) on these issues. The knowledge acquired can be found in the marketing management support systems literature. “Marketing management support systems” does not just refer to a collection of decision support systems and technologies, but also to a substantive field with an emerging body-of-knowledge about the factors and conditions that affect the adoption, use, and impact of marketing decision support tools in organizations. We do not have enough space here to review this area. The reader is referred to books such as Wierenga and Van Bruggen (2000) and Lilien and Rangaswamy (2004), and to Special Issues of academic journals such as Marketing Science (Vol. 18, No. 3, 1999) and Interfaces (Vol. 31, No. 3, 2001). The most recent insights can be found in Wierenga, van Bruggen and Althuizen (2008).

3. Opportunities for Decision Support Systems in Marketing

In this section we will discuss developments that are favorable for the development, adoption, and use of marketing management support systems in companies. An overview is given in Table 1.

- Higher quality marketing management support systems
- More favorable user environments
- The third marketing era
- Customer relationship management (CRM)

Table 1: Opportunities for Decision Support Systems in Marketing

Higher quality marketing management support systems

At the time of the early work in marketing models (Bass, Buzzell, and Greene 1961; Buzzell 1964; Frank, Kuehn, and Massy 1962; Montgomery and Urban 1969; Kotler 1971), the knowledge about marketing processes was limited. This sometimes led to the development of overly simplistic models that were not very usable for marketing practice. So, more work was needed here. We already observed that the use of marketing models in practice remained behind the initial expectations. Interestingly, a completely different situation has developed in academic research. Here, marketing model building or “marketing science” has become one of the dominant areas of research in marketing. It looks as though the field of marketing models “retracted” from the battlefield of actual marketing decision-making to the academic halls of science. The focus of academic marketing models is more on developing fundamental insight into marketing phenomena (just like physical models are used to obtain insight in the working of nature) than on immediate decision support. It is not always easy to predict the value of a particular approach in marketing science for marketing practice. For example, Simon (2008) may be right that the early work on econometric models had limited impact on marketing practice. However with today’s abundance of marketing data the help of skilled econometricians, statisticians and computer science people is very much needed in order to turn this data into knowledge for marketing action. For example, in direct and online marketing where the offers to individual customers are optimized on the basis of their purchase histories, econometric skills are indispensable (Bucklin 2008). To give another example, causal modeling may not often be used to solve a marketing problem for one particular company at one particular point in time, but it does help to produce general marketing insights from large datasets, for example about the effectiveness of customer relationship management (Reinartz, Krafft and Hoyer 2004).

The modeling approach has produced a wealth of knowledge about marketing processes and the key variables that play a role in these processes. Furthermore, very sophisticated methods and tools for the measurement and analysis of marketing phenomena have been developed. These advances have been documented in a series of books that appeared with intervals of about 10 years: Kotler (1971), Lilien and Kotler (1983), Lilien, Kotler and Moorthy (1992) and Eliashberg and Lilien (1993). The edited volume: Handbook of Marketing Decision Models (Wierenga 2008a) appearing this spring presents the current state-of-the-art.

Over time, marketing models have become “deeper”, in the sense that more relevant variables are included. This

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1 For example, linear advertising models that were fit for optimization through linear programming, rather than for describing how advertising really works (Engel and Warshaw 1964).
has made marketing models more realistic and better adapted to actual marketing problems in practice. We can demonstrate these developments by looking at models for sales promotions. In Kotler’s (1971) book the discussion of sales promotions is limited to two pages (47-48), with just one formal model for finding the best sales promotion. In the meantime, researchers have realized that sales promotions is a multi-faceted phenomenon, with aspects such as acceleration, deceleration, cannibalization, category switching, store switching, and many others (Van Heerde and Neslin 2008). Similar progress has occurred in the modeling of other phenomena in marketing, such as advertising, sales management, and competition.

Also, the procedures for parameter estimation have become much more sophisticated (from least squares to maximum likelihood to Bayesian estimation methods). So the analytical capabilities component of marketing management support systems, i.e. marketing models, has significantly improved in quality. This is also the case for the information technology component. Using state-of-the-art IT possibilities, most MMSS now have user-friendly interfaces, are easy to use, and are pleasant to work with. As we will see, they are often completely embedded in the IT environment in which a marketing manager works. The situation with respect to another critical component of MMSS, marketing data, has also improved dramatically over time. First, scanner data caused a “marketing information revolution” (Blattberg et al. 1994), and more recently this was followed by a second information revolution in the form of enormous amounts of CRM data, clickstream data, and all kinds of interactive marketing data.

The conclusion is that because of better models, more sophisticated information technology, and better data, the quality of marketing management support systems has tremendously improved. This is a favorable factor for their use and impact.

MMSS-favorable user environments

Thirty years ago, Little (1979, p. 23) observed that computers “are impossible to work with” and he foresaw the need for “marketing science intermediaries”, professionals with good technical skills who would entertain the connection between the computer and the manager. Through the spectacular developments in IT, the reality of today is completely different. The computer is now the most intimate business partner of the manager. Whether it is in the form of a PC, a laptop, a terminal in a network or a PDA, the computer is completely integrated in the daily work. A recent study among German managers reported that managers spend on average 10.3 hours per week using information technology (Vlahos, Ferrat, and Knoepfle 2004), i.e., about 25% of their work time. The comparable figure for the U.S. is 11.1 hours per week and for Greece 9.3 hours (Ferrat and Vlahos 1998). Marketing and sales managers spend on average 8.6 hours per week using the computer (a bit lower than the 10.3 hours overall), which makes it clear that for marketers the computer is now a key element of the job. Today, a marketer typically has several databases and spreadsheet programs available that are used to monitor sales, market shares, distribution, marketing activities, actions of competitors and other relevant items. Such systems are either made in-house, i.e., by the firm’s own IT department, or made available by third parties. Providers of syndicated data such as Nielsen or IRI, typically make software available for going through databases, and for specific analyses. For the adoption and use of MMSS it is an important advantage that marketing managers are fully connected to an IT system. When a new MMSS is to be introduced, the “distribution channel” to the marketing manager (i.e., the platform) is already there. In this way, using the MMSS becomes a natural part of the (daily) interaction with the computer. One step further, marketing decision support tools are not separate programs anymore, but have become completely embedded in other IT systems that managers use (see Lilien and Rangaswamy, 2008). In some cases, with very complex decision support systems, the decision maker may need the assistance of the system developer in order to obtain valid results. However in general this is not advisable, because it means a big impediment for the use of a decision support system. The real power of decision support systems is that they are directly accessible to the decision maker in an interactive way and are operational at the very moment that a decision issue emerges.

For the success of MMSS, the relationship between the marketing department and the IT/IS department in a company is critical. There are indications that the power balance between marketing and the firm’s overall information department is changing in favor of marketing. In a study among managers of market research in Fortune 500 companies, Li, McLeod and Rogers (2001) concluded that marketing has an increasing influence on the company plan for strategic information resources and that marketing now occupies a “position of power in the organization in terms of computer use with marketing generally calling the shots” (p. 319). This is a big change from the early days of computers in companies, when marketing occupied one of the last places in the IT priority queue, after accounting, finance, production, and operations.

The third marketing era

Marketing became an academic discipline around the beginning of the 20th century.

Broadly speaking, we can distinguish three different “eras” in marketing, in which the type of data used for marketing decisions evolved significantly.

(1) Marketing as distribution (1900-1960)

In the beginning the focus in marketing was on distribution. Researchers were interested in how products go...
through the distribution channel from the original producer (e.g. farmers) to the ultimate consumer. Products were seen as commodities, anonymous products went to anonymous consumers. Marketing was studied at the macro/industry level rather than as a managerial activity of individual companies. The variables of interest and the data that were used were also defined at high levels of aggregation, for example: total production of a particular product, total sales, consumption per capita, average consumer price, etc.

(2) Marketing as brand management (1960-2000)
In the fifties of the last century, after the “invention” of the marketing mix, marketing changed completely. From a field that studied interesting phenomena in distribution channels, it became a managerial field with as its main question of how to determine the elements of the marketing mix in such a way that the total profit (or some other organizational goal) of the company is maximized. In this marketing era, marketing models were primarily marketing mix models, focusing on the relationship between marketing instruments and sales or market share (Wierenga 2008b). Engelke and Simon (2007) give a classification of applications of marketing decision support systems according to the marketing mix instruments involved. In their set of applications price and product decisions are very important, followed by product line decisions, sales force and distribution decisions. In the second era practically all the information in the marketing management support systems of the time was organized around brands. In this period the so-called scanner data revolution took place: obtaining information about brand sales from the scanning of product barcodes at check-out counters.

(3) Marketing as customer orientation (customer-centric marketing) (2000–)
Marketing as customer orientation (customer-centric marketing) emerged toward the end of the twentieth century. Information technology made it increasingly easy to collect and retain information about individual customers. This was not only demographic information (e.g., family stage, age, and education for consumer marketing; company size and industry for B-to-B marketing), but also information about their purchase history, and their responses to marketing campaigns. This means that individual customers were no longer anonymous but obtained their own identity. With such information a company knows precisely with whom it is dealing, and can figure out the best way of interacting with a particular customer. This is a major shift from the previous era. The individual customer has become central. This does not mean that brands have become obsolete. We can say that after the product had lost its anonymity (and became recognizable as a brand) in the second marketing era, the third marketing era has also given the individual customer an identity. Customer-centric marketing requires new marketing metrics, such as, customer share, customer satisfaction, and customer lifetime value (CLV). Customer-centric marketing also causes a shift in the focus of marketing management support systems, where data are increasingly organized around individual consumers. In the third marketing era a lot of effort is put in the development of customer data bases, which are the starting points for any interaction with individual customers. According to Glazer (1999) the customer information file (CIF) is the key asset of a corporation. From the perspective of MMSS, the transition to the third marketing era is a tremendous step forward. Individual customer-level data are an enrichment of our information about what is going on in the marketplace. The new data has also stimulated the development of all kinds of new types of marketing models, which can be used to optimize marketing efforts at the level of the individual customer (Gupta and Lehmann 2008; Reinartz and Venkatesan 2008; Bucklin 2008). The third marketing era has significantly increased the opportunities for marketing decision support systems.

Customer Relationship Management (CRM)
Customer relationship management (CRM) has been called the “new mantra of marketing” (Winer 2001). Customer relationship management is an enterprise approach aiming at understanding customers and communicating with them in a way that improves customer acquisition, customer retention, customer loyalty and customer profitability (Swift 2001). The basis for doing this is the CRM system, a computer system with a data base with data about customers, about company-customer contacts, and data about the customers’ purchase history. Recently, companies have been installing CRM systems at a high rate and a large number of companies now have functioning CRM systems in place. Of course, the large scale adoption of CRM systems by companies is directly related to the transition to the third marketing era, described above. CRM systems are basically used for two purposes:

(1) To support and optimize day-to-day interactions with customers. This is called operational CRM;

(2) To enable firms to leverage on data and find new marketing opportunities, for example, the need for specific products/services among certain customer groups, opportunities for cross-selling, opportunities for event-driven marketing, etc. This is called analytical CRM.

Since the very purpose of a CRM system is to offer decision support for the interaction with customers (operational as well as analytical), every CRM system is a marketing management support system. Hence, the advent of CRM systems implies a quantum leap in the number of MMSs in companies. Interestingly, the companies that are at the forefront of implementing CRM systems are not the same companies that were dominant in the development of MMSs for brand management in the second marketing era. The CRM movement is particularly strong in industries like financial services (e.g., banks and insurance companies), telecommunications, utilities,
recreation and travel, whereas in the second marketing era the consumer packaged goods companies were dominant.

There are enormous opportunities for the analysis and optimization of marketing decisions with the data in CRM systems. An example of a frequently employed methodology is data mining. With data mining a prediction model (e.g., a neural net, Hruschka 2008) is trained to learn the association between customer characteristics (for example, demographical information and purchase history) and interesting dependent variables (for example, whether or not the customer has accepted a specific offer). Once the model has been trained, it can be used to predict whether other customers (with known characteristics) will accept the offer. This technology is typically used in marketing campaigns to select those customers from a database that have a high probability of accepting a particular offer. Data mining can cause large savings, because of a better allocation of expensive marketing resources. Many questions can be answered with the intelligent use of the data in CRM systems, such as: which customers should we acquire, which customers should we retain, and which customers should we grow (Reinartz and Venkatesan 2008).

Today, the interaction between companies and their customers is increasingly taking place over the Internet. This has created another source of valuable information: i.e., clickstream data that provide information about how customers behave on websites and about their information acquisition processes. In online marketing settings, companies can produce tailor-made offers to individual customers, advertisement exposure can be individualized through search-engine marketing, and companies can offer Interactive Consumer Decision Aids (Murray and Häuble 2008) to help customers with their choices. To support online marketing, new marketing models are needed. For example, models for the attraction of visitors to a site, models for the response to banner ads, models for paid search advertising, and models for site usage and purchase conversion (Bucklin, 2008). The most important advances in marketing models and MMSS in the coming years will occur in the domains of CRM and interactive marketing.

4. Decision Support Systems as the Bridge between Marketing Science and Marketing Practice

We have seen that the conditions for successful marketing decision support systems have significantly improved over the last few years, and we expect them to become even better. This is important since decision support systems fulfill an important role. We have learned over the last five decades that it requires painstaking work, high quality data, sophisticated models, advanced computational capabilities and qualified researchers to get a thorough understanding of marketing phenomena, which is needed for marketing decision making. The marketing modeling community has shown impressive achievements in this respect, as exemplified by the books mentioned earlier and by the articles in the model-oriented academic journals. Still, compared to the many centuries of research in physics, we are only at the beginning of our understanding of marketing phenomena. We have also learned that even if the knowledge and the models are available, companies do not always use them for the improvement of marketing decisions. There are major barriers, related to individual decision makers and to the organizations in which they operate, that work against the implementation of marketing decision models in practice.

There is a big gap between the scientists who develop the analytical marketing tools and the practitioners who are expected to implement and use them. We all know the huge difference between the world of academics who like to analyze and solve problems in a thorough and solid way and the world of managers whose activities can be characterized by brevity, variety, and discontinuity (Mintzberg 1973). It is easy to blame the model builder for being more interested in the model than in its application, and the practitioner for not immediately embracing those wonderful models. However it is more realistic to admit that often the implementation is beyond the expertise, incentive systems and available time of either of these two parties. An interface in the form of a decision support system is needed as the missing link between science and practice. The development of successful decision support systems requires a separate type of experts: people who understand marketing decision problems good enough to see what the manager needs, and at the same time have sufficient technical skills to turn models into working decision support systems. We might call them “marketing engineers”. The success of a marketing management support system is dependent on a large number of variables (Wierenga, Van Bruggen and Staelin 1999), for example the type of organization and its decision making culture, the dynamics of its markets, the availability of data, the decision support technology applied (e.g. models, expert systems or neural nets), design characteristics of the system (user interface, accessibility, flexibility), and how the system is implemented (user involvement, top management support, training). It takes thoughtful and deliberate consideration and advanced marketing engineering capabilities to design and implement a marketing management support system that successfully bridges the gap between model and decision maker in a particular situation. The examples of successful marketing decision support systems mentioned in the introduction of this article are very encouraging. Based on the developments discussed in this paper, we expect a further growth of these support systems, in their availability, their capabilities, and their contribution to the quality of marketing decisions.
References


... certainly a must for anyone who does a lot of business translation