

**MARKETING MANAGEMENT SUPPORT SYSTEMS:  
EVOLUTION, ADOPTION AND EFFECTIVENESS**

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**SUMMARY**

A Marketing Management Support Systems can be defined as any device combining (i) information technology, (ii) marketing data and/ or knowledge, and (iii) analytical capabilities, made available to one or more marketing decision-makers with the objective to improve the quality of marketing decision-making. In this paper we present a categorization scheme for marketing management support systems. Three types of MMSS, developed so far, can be identified: marketing information systems, marketing decision support systems and marketing knowledge-based systems. Each of these systems emphasize different components.

Next, we focus on the factors affecting adoption of and satisfaction with MMSS. The outcomes are presented of a large scale study carried out in the Netherlands among 525 companies. In the third part of the paper we answer the question whether MMSS improve the effectiveness of marketing decision-makers and, if so, under which conditions. For this purpose we present the results of an experimental laboratory study in which 80 real life marketing managers and 160 marketing students participated.

We conclude the paper with a discussion of the perspectives for Marketing Management Support Systems.

**1. INTRODUCTION**

Since the arrival of the computer in companies, marketing people have been actively exploring its potential for supporting marketing management decisions. This has resulted in a large number of different tools and systems, developed inside and outside companies, that are now available as decision aids for the marketer. There is not only a large variety in these tools with respect to their methodology, required inputs, technologies used and area of application, but there also seems to be a broad spectrum of names under which these tools and systems are referred to in practice and academia.

In this paper we will use the term *marketing management support systems (MMSS)*<sup>1</sup> to refer to the whole set of these systems and tools meant to support a marketing decision-maker (a more precise definition will be given shortly) and the first objective of this paper is to present a categorization-system that will help to see the distinctions between the different tools. This categorization system will also help to develop a perspective on the evolution of Marketing Management Support Systems over the last three decades. Secondly, this paper addresses the question of adoption of and satisfaction with marketing management support systems. To what extent do companies develop or acquire such systems, what are the characteristics of the "early adopters" in this respect and which factors determine the satisfaction with marketing management support systems in companies? These questions will be answered using the results of a large scale survey in the Netherlands.

Thirdly, the important question of the effectiveness of a marketing management support systems is dealt with: does an MMSS really improve the quality of marketing decision-making and, if so, under which conditions? To answer this question the results of an experimental study will be discussed in which the effects of using MMSS on the marketing performance are examined, both with real-life marketing managers and marketing students as participants.

In the final section of the paper, the perspectives for MMSS will be sketched, based on both the findings reported in this paper and general developments in marketing and information technology (IT).

## 2. EVOLUTION OF MARKETING MANAGEMENT SUPPORT SYSTEMS

When we think about the essence of marketing management support systems, an important observation seems to be that such systems offer their contribution through a *combination of a set of components* and that different types of marketing management support systems can be distinguished because they emphasize different components. The basic components are indicated in Figure 1.

All MMSS make use of *information technology (IT)* in the form of hardware (computers, PC's, input-output devices etc.) and software (database management systems, spreadsheets, windows etc.).

Secondly, an MMSS can have *analytical capabilities* available in the form of statistical packages to analyze marketing data, estimation procedures to estimate parameters, marketing models (e.g. response functions for marketing-mix instruments) and optimization and simulation procedures.

In the third place we have *marketing data*: quantitative information about marketing variables like sales, market shares, prices, own marketing-mix expenditures, competitors' marketing-mix expenditures, distribution figures etc.

The fourth component is *marketing knowledge*. This refers to qualitative knowledge a marketer can have about his brands and markets, for example about the suitability of

specific marketing actions (e.g. sales promotions) in specific circumstances, the way consumers will react to specific types of advertising, the attributes that consumers find important in a product, the marketing strategies of competitors, etc. This qualitative knowledge is the result of experience and intuition.

The four components model of an MMSS depicted in Figure 1 illustrates the developments since the late sixties. In 1969 Montgomery and Urban also presented a scheme for an MDSS (later modified by Little, 1979) with four elements labelled as models, statistics, optimization and data.

FIGURE 1: THE FOUR COMPONENTS OF A MARKETING MANAGEMENT SUPPORT SYSTEM



Our representation of MMSS encompasses the Montgomery and Urban scheme: their models, statistics and optimization are included under our heading *analytical capabilities*, and we have also a (*marketing*) *data* component.

However, when talking about marketing management support systems in 1993, we feel it necessary to add two components.

It has become clear that Information Technology is an autonomous driving force in the development of MMSS. Think of the tremendous impact of the PC, the advent of user-friendly interaction procedures with the computer (mouse, windows, etc.) and of new programming technologies such as object-oriented programming.

As a second component, mainly due to the developments in the field of Artificial Intelligence, the importance of (qualitative) marketing knowledge has been recognized. This knowledge (well to be distinguished from marketing data) can be captured, stored in computers and used to support marketing decision-making.

<sup>1</sup> From here onwards, the abbreviation MMSS is used for both marketing management support system (singular) and marketing management support systems (plural). The abbreviations MKIS, MDSS and MKBS are used in the same way.

Based on our model in Figure 1 we can now give the following definition of a marketing management support system:

a marketing management support system is any device combining (i) information technology, (ii) marketing data and/or knowledge, and (iii) analytical capabilities, made available to one or more marketing decision-makers with the objective to improve the quality of marketing decision-making.

We can now position the various MMSS with respect to their emphasis on the different components mentioned in this definition.

The first category of systems are the *marketing information systems* (MKIS). These systems are the results of the application of the concept of management information systems to the marketing field. The first MKIS were mainly a combination of *marketing data* and *information technology* (systems for storage and retrieval). Later on statistical procedures (*analytical capabilities*) were added. Therefore, now MKIS consist of a data base (with the marketing data) and the ability to apply statistical analyses to these data. The marketing data are gathered by performing marketing research. The statistics bank provides the user with a number of statistical techniques to transform the data into information. A marketing information system can, for example, contain data about marketing expenditures, prices and sales figures for a number of products in a number of periods. By performing statistical analyses, relationships between the different variables can be investigated, for example the relationship between advertising expenditures and sales. Such an analysis provides the marketing decision-maker with information about the effectiveness of his advertising expenditures.

*Marketing decision support systems* (MDSS) form the second category of MMSS. Like MKIS, marketing decision support systems combine information technology, marketing data and analytical capabilities, but with much much more emphasis on the *analytical capabilities*. Little (1979) defines an MDSS as:

"a coordinated collection of data, models, analytical tools, and computing power by which an organization gathers information from the environment and turns it into a basis for action" (p. 9).

An MDSS differs from an MKIS in that it contains a model base in addition to both the data base and the possibility to apply statistical analyses. Furthermore, an MDSS often also contains simulation and optimization procedures. Therefore an MDSS can be conceived of as an extension of an MKIS. The model base can contain three major classes of quantitative models: descriptive models, predictive models and normative models. According to Montgomery and Urban (1969) descriptive models are concerned with providing detailed and accurate representations of phenomena, predictive models are used to forecast the system's future behaviour and normative models yield solutions or recommend decisions to solve problems. Dependent on the specific situation, a model

from one of these three classes can be selected to help the marketing decision-makers in designing marketing actions. Instead of focusing on efficient data processing or information generation, MDSS focus on supporting the decision-making process. The aim of this category of systems is to let the decision-maker make more effective decisions (e.g. resulting in a higher market share or more profit). MDSS can, for example, help a marketing decision-maker to search for the optimal level of advertising expenditures, given certain goals he wants to reach (i.e. a certain level of brand awareness).

The third category of MMSS is *marketing knowledge-based systems* (MKBS)<sup>2</sup>. These systems are focused on the manipulation of (mainly qualitative) knowledge and are the result of the application of AI-technology to the marketing field. These systems emphasize the combination of *information technology* and *marketing knowledge*. Marketing managers rely upon experience, knowledge, and intuition to diagnose marketing problems, configure marketing programs to achieve some stated objectives or evaluate new marketing opportunities (Rangaswamy et al., 1987). In developing marketing knowledge-based systems, experience, knowledge and intuition are built into a computer program. MKBS can be used for tasks such as monitoring, diagnosing and planning. Examples of these systems are PEP (Bayer, Lawrence and Keon, 1988) and ADCAD (Burke et al., 1990). PEP is a system, designed to investigate the planning of consumer sales promotion campaigns. ADCAD is a system, designed to assist advertisers of consumer products with the formulation of advertising objectives, copy strategies and communication approaches. Wierenga (1992) analyses twenty-seven marketing expert systems. Advising about sales promotions and monitoring markets are the most frequent functions dealt with by, marketing expert systems. The problems handled by the marketing expert systems so far have, for the greater part, been narrow, relatively structured, programmable and operational, i.e. "small" problems (Wierenga, 1992).

The order in which we discussed the three types of marketing management support systems: marketing information systems, marketing decision support systems and marketing knowledge-based systems is not arbitrary but reflects the evolution of computer support to marketing over time.

First there were the (simple) MKIS, simple database management systems for storage and retrieval of marketing data, to which later some analytical capabilities were added. This was the situation of the early eighties.

During the eighties we saw the emergence of marketing decision support systems, which made extensive use of the results from the strong model building tradition in marketing, existing since the sixties.

Marketing knowledge-based systems date only from the second half of the eighties, the time when expert systems were rolled out of the AI-labs everywhere.

Of course the typology of MMSS given here is rather broad. Within each type of MMSS

<sup>2</sup> Marketing Expert Systems (MES) are a subset of marketing knowledge based systems (MKBS). MKBS use a number of knowledge sources (experts, textbooks etc.) while MES use only one knowledge source, i.e. experts.

mentioned, a further classification can be carried out. This is done for MDSS in Section 3, for example.

### 3. MARKETING DECISION SUPPORT SYSTEMS: ADOPTION AND SATISFACTION

This section deals with the type of MMSS that at this moment seems to be most prominent in companies in practice: marketing decision support systems (MDSS), i.e. (according to our definition) systems that combine analytical capabilities, marketing data and IT.

In the marketing literature several articles can be found that more or less *illustrate* the use and impact of marketing decision systems. An often cited article is Moriarty and Swartz (1989) that gives examples of how automation is used to support marketing and sales and of the (substantial) effects of these systems. Whereas Moriarty and Swartz's examples are mostly in the area of business-to-business marketing, Eisenhardt (1990) shows how consumer product companies use marketing decision support systems and claim to obtain (fabulous) pay-out ratios for their investments in these systems.

However, there is very limited *systematical* knowledge about the actual adoption of and satisfaction with marketing decision support systems in companies and little insight in the factors (company factors, marketing factors, personal factors) that affect adoption and satisfaction.

In this section we will present the major outcomes of a large scale study that was carried out in the Netherlands among 525 companies, which gives information not only about the actual adoption of Marketing Decision Support Systems (MDSS) in companies, but also about the factors affecting the satisfaction with these systems among marketing decision-makers.

Although the data are limited to the Netherlands, we think that the implications of the study are wider. The actual adoption levels of MDSS in other countries may be different from that in the Netherlands, but it is reasonable to assume that the factors affecting adoption are quite general. Also the hierarchical scale, developed to measure the sophistication of a specific MDSS, is applicable everywhere.

The study was carried out by the first author and three colleagues: Van Campen (now with Heineken), Huizingh (University of Groningen) and Oude Ophuis (Wageningen Agricultural University).

Given the space limitations, only a summary of the design of the study and its outcomes can be given here. For more specific information the reader is referred to other sources: a descriptive account of the study in Dutch is: Van Campen, Huizingh, Oude Ophuis and Wierenga (1991); the research model and the substantive finding are dealt with in Wierenga and Oude Ophuis (1993); the hierarchical scale is developed and tested in Wierenga, Oude Ophuis, Huizingh and Van Campen (1991).

#### *Design of the study*

The purpose of the study was to determine the level of adoption (penetration) of MDSS in Dutch companies and the factors that affect adoption and satisfaction with MDSS. Information was obtained from a sample of companies with respect to these variables

and a number of other variables: company characteristics, marketing organization and procedures, characteristics of the marketing decision-makers and information about the development and implementation process of the MDSS.

The data were collected through computer-assisted telephone interviewing. The sample framework was the set of Dutch companies with 10 or more employees who have an identified marketing manager or an employee with a job title that is equivalent to marketing manager. The presence of a marketing manager (or the equivalent) is taken as an indication for the marketing orientation of the company. This criterion was chosen to avoid companies who have no marketing orientation at all and are not useful to contact about their marketing decision support systems. Of course the results should be interpreted against the background of this sample framework. The interviews were carried out by (advanced) marketing students; the respondents were the marketing managers as indicated.

There was a substantial amount of cooperation: the number of completed interviews was 525 from a sample of 1014, which implies a response rate of 52%. The data collection took place in May 1990.

#### *A hierarchical classification scale for MDSS*

Marketing Decision Support Systems in companies show a large variety in forms, structure, hardware, software, depth and breath of application. If one wants to study MDSS as they can be observed in practice, a (measurement) system is needed to classify MDSS in relevant categories.

We developed such a classification system with the following features:

- focus on the functionality of the system and not on the actual form in which an MDSS appears;
- hierarchical nature, based on the notion that there is a hierarchical ordering with respect to sophistication: a system with some functional capability A will also have the less sophisticated functional capability B, but not necessarily the other way around;
- five different levels which can interpreted as (increasing) levels of sophistication.

Conceptually a scale for an MDSS can have the following five levels:

- (o) no analytical tool used at all to support marketing decision;
- (i) an MDSS which only does status reporting and can answer the questions 'what happened?' Many systems do not go beyond this point and report items such as sales, market share, price etc.
- (ii) a one step more advanced MDSS which is able to give causes of events and answer the question 'why did it happen?' Such a system can carry out causal analyses for example to explain sales or market share by variables like advertising, personal selling effort, sales promotion etc. A level ii system would be an MKIS, as defined in Section 2.
- (iii) an MDSS that can predict the outcomes of marketing actions considered, i.e. 'what will happen if?' For this purpose the MDSS should contain models that



quantify the relationships between marketing variables (e.g. price) and outcome variables (e.g. sales). Such models can be used to simulate the outcomes of marketing actions;

- (iv) A system that can help to find the best action and answer the question: 'what should happen?' In order to answer this question such an MDSS needs to have an objective function and optimization methods.

There is an implied hierarchy in these five levels: for example a system that is able to answer the question of 'why did it happen'(ii), which implies some form of data analysis, should also be able to answer the question 'what happened?' (i), i.e. contain the data, required for the analysis. Furthermore, for example, to answer 'what should happen?' questions (iv), objectives and optimization models are not sufficient, but we need models (level iii), analytical methods to parameterize these models (level ii) and data to carry out the analyses (level i). So every following level also contains all the capabilities of lower levels.

This notion of a hierarchy was the starting point for developing a Hierarchical MDSS Scale (HMS): Wierenga et.al. 1991, where the Guttman scale (Guttman 1944) - well known in the marketing research community- was used as a modelling device. To determine for a specific MDSS its position on the HMS scale, it is sufficient to answer a number of questions with respect to the data the system contains, its capabilities to analyze the causes of marketing events, its capabilities for conditional forecasting (simulation) and its optimization capabilities.

Within the Guttman framework the hierarchical nature of the MDSS can be tested statistically. For our data of 194 companies with an MDSS (see further), the hierarchical scale was confirmed. This HMS makes it possible to compare MDSS from different companies on a common dimension: sophistication.

#### *Results with respect to adoption of MDSS in companies*

In Table 1 the adoption level of MDSS, together with information about PC's and terminals in Dutch companies is presented. With respect to the presence/absence of MDSS, the respondents, after having being given a (broad) description of an MDSS, had to answer the question: 'Does your company have a system that is used or could be used by different persons in the organization and that could be considered as a marketing decision support system?'. Table 1 shows that the adoption of MDSS in the sample is 37%: 194 of 525 companies answered that they have an MDSS.

Table 1 also shows that many of the MDSS are of a modest sophistication level: more than half do not go beyond data storage/retrieval/data analysis and do not contain simulation and optimization possibilities. Such systems are in fact MKIS.

From the first column of Table 1, one might obtain a too optimistic impression of the adoption of MDSS in Dutch companies. It should be remembered that the companies in the sample were selected on the presence of a marketing manager. This latter condition applies to 7.3% of companies with more than 10 employees. So if we project the outcome of the sample to all Dutch companies with 10 employees or more, we arrive at the adoption figures for the different MDSS-levels in the second column of Table 1. We can interpret these numbers as lower levels, since the calculation assumes that none

of the companies without a marketing manager has an MDSS. These numbers put us back to reality: the estimated adoption rate of MDSS in Dutch companies is about 2.5% when we include all MDSS levels. If we look only at the most sophisticated MDSS (level 4), we arrive at an adoption percentage of only one half percent<sup>3</sup>.

TABLE 1: ADOPTION OF PC'S, SOFTWARE PACKAGES AND MARKETING DECISION SUPPORT SYSTEMS IN MARKETING DEPARTMENTS OF DUTCH COMPANIES

	Adoption in the sample of 525 companies	Lower level of adoption in all companies with $\geq$ 10 employees
	%	%
PC's, terminals/ workstations	96 (88) *	-
MDSS all	37 (32) *	2.60
level 0	2	0.10
level 1	8	0.60
level 2	11	0.77
level 3	8	0.61
level 4	7	0.51

\*) Comparable figures for the USA: Higby and Farah (1991)

It would be interesting to compare the adoption levels of MDSS found for the Netherlands with similar statistics from other countries. We found only one study carried out in the U.S.A. at about the same time, that could serve this purpose: Higby and Farah (1991). They applied a similar sample frame as we did by sending a mail survey to marketing executives (n=2993). Their response was substantively lower (7%) compared to the Van Campen et.al. study, but it is surprising that the adoption levels they find for MDSS and PC's in the marketing departments of companies are not far off: 32 and 88% respectively. If we neglect the differences in response rate between both studies for the moment, we might say that MDSS adoption levels by companies in the Netherlands are at least as high as in the U.S. Unfortunately, the Higby and Farah study did not look at

<sup>3</sup> In absolute numbers, since there are about 40,000 companies with 10 employees or more in the Netherlands, the estimated numbers of MDSS would be about 1000, the number of level-4 systems about 200.

the different sophistication levels within MDSS, so we cannot make comparisons in that respect.

#### Implementation

A few statistics about the implementation of an MDSS might be interesting. First of all there is the question of make-or-buy. It turns out that do-it-yourself is the favourite approach: 69% of the systems were developed in the own company, 31% were purchased from an outside seller.

One would expect that the marketing department plays the dominant role in the purchasing/developing of an MDSS. However, this turns out not to be the case. For systems bought from outside, the party that most often takes the initiative is top management (46%) and not marketing (30%). For internally developed systems the IS-department is the leading party most often (47%) and marketing only in 14% of the cases. So the role of marketing is modest and it probably occurs that the MDSS is 'forced upon' the marketing people. Of course, this is not a positive factor for the acceptance of and satisfaction with the MDSS.

In many cases (62%) there is a specific person in the company who acts as the "MDSS-champion". This is seen quite often: a successful innovation is driven by an enthusiastic person from within the company. The median value of the estimated initial investment, required for the MDSS was Dfl. 200,000.- (about US \$110,000.-). The median amount of the annual maintenance costs was Dfl. 30,000.- (about US \$17,000.-). The average values for initial investment and maintenance costs are Dfl. 700,000.- and Dfl. 80,000.- respectively.

#### Factors related to adoption

Table 2 gives information about the factors that are related to the adoption of MDSS in companies. These factors are classified into a number of categories.

MDSS are found relatively more often in companies with larger revenues and more employees i.e. larger companies (company characteristics). Companies with a marketing department, with a marketing research department and with marketing software packages are more likely to have an MDSS than other companies (marketing organization and resources). Not surprisingly the presence/absence of an MDSS is also related to the marketing procedures of a company and correlates positively with the use of an (annual) marketing plan and the number of marketing-mix variables that are regularly dealt with. It turns out that support from within the company is very important: adoption is influenced positively when topmanagement and colleagues stimulate the use of MDSS. Also communication plays a major role: the number of information sources about MDSS and whether or not one has seen a successful implementation of an MDSS in another company. So diffusion of MDSS is positively influenced by supplying information (colleagues and outside presentations of MDSS are important sources) and by seeing others successfully use MDSS. This looks familiar within the context of what is known about diffusion of innovations in general.

TABLE 2: FACTORS RELATED TO ADOPTION OF MDSS BY COMPANIES (N=525)

		Bivariate correlation with ADOPTION	Significance in multivariate analysis
Company characteristics	REVENUE EMLPSIZE	0.17 a) 0.13	
Marketing organizations and resources	MARKTDEP MRESDEP MARKTSOFT	0.13 0.18 0.17	+ b)
Marketing procedures	MARKPLAN MARKMIXN	0.13 0.14	++ b)
Within company support	TOPMSUPP COLLSUPP	0.25 0.31	++ ++
Communication sources	INFOSRCS SUCCOTH	0.22 0.24	+ +

a) All printed coefficients are significant at  $\alpha = 0.05$

b) + and ++: positive relationship at significance levels of 0.05 and 0.01 respectively  
- and --: negative relationship at significance levels of 0.05 and 0.01 respectively

#### Satisfaction

Overall there is a considerable level of satisfaction with the MDSS. On a 5-point satisfaction scale 54% of the respondents gives a 4 or 5 and only 10% gives a 1 or 2. The average satisfaction score is 3.40. As Table 3 shows, several variables are significantly related to satisfaction. Many of the variables are personal characteristics. For example, the satisfaction is higher for older respondents, male and with lower education level. One explanation here is that many of the actual MDSS were quite simple and therefore less appealing to younger and higher educated marketers (and therefore also to women?).

A very important factor is whether or not the marketer uses the MDSS personally through direct interaction with the system. If this is the case, this significantly contributes to satisfaction. Support from topmanagement appears also to be an important factor for satisfaction. Furthermore, it is important to involve the marketer in the development and implementation process: an important role of the marketer and a high perceived participation in this process contributes to a high satisfaction level. Also the presence of an MDSS champion turns out to be a positive factor.

Furthermore, it appears that adaptability is a key factor (marketers do not like rigid

systems) and that more sophisticated systems (in the sense of the HMS scale) are favoured above simple systems.

TABLE 3: FACTORS RELATED TO SATISFACTION WITH MDSS (N=194)

		Bivariate correlation with SATISFACTION	Significance in multivariate analysis
Company characteristics	MARKSHRE	-0.15 a)	
Marketing organizations and resources	MRESDEP	0.16	
Characteristics of marketing decision-maker	AGE	0.15	-- b)
	GENDER	-0.25	
	EDUC	-0.12	
	INTERACT	0.21	
Within company support	TOPMSUPP	0.30	++
Development and implementation process	MARKROLE	0.18	+
	PERCPART	0.30	
	MDSSCHMP	0.13	
Features of MDSS	ADAPT	0.49	++
	SOPHISTIC	0.25	

a) All printed coefficients are significant at  $\alpha = 0.05$

b) + and ++: positive relationship at significance levels of 0.05 and 0.01 respectively  
- and --: negative relationship at significance levels of 0.05 and 0.01 respectively

#### 4. EFFECTS OF MARKETING MANAGEMENT SUPPORT SYSTEMS

In the literature of marketing science a lot of attention has been paid to the development of marketing decision aids, more specifically on marketing modelling. The works of Montgomery and Urban (1969), Little (1975), Naert and Leeflang (1978) and Lilien, Kotler and Moorthy (1992) are typical of this category of literature.

Less attention has been paid to the issue whether the use of these decision-aids really helps decision-makers in improving their performance and, if so, under which conditions. However, this issue is an important one. Research of van Campen et al. (1991) shows that the average investment costs of MDSS in the Netherlands are Dfl.

700.000,- while the average maintenance costs are Dfl. 80.000,- a year. These are high costs and to make the investment in MMSS profitable there should also be substantial benefits opposite to these costs.

Three of the best known studies which address this issue are the ones by Fudge and Lodish (1977), Chakravarti, Mitchell and Staelin (1979) and McIntyre (1982). Fudge and Lodish (1977) report a field experiment on the performance effects of CALLPLAN, an interactive management science model to support the planning of a salespersons account-call frequency schedule. After six months the average CALLPLAN salesperson had 8.1% higher sales than his non-CALLPLAN counterpart. Chakravarti et al. (1979), in a laboratory experiment, investigated the effects of the use of the decision-calculus model ADBUDG, for supporting advertising decisions. The experiment indicated that the use of this model does not improve the quality of decision-making and may in fact even lead to poorer decisions. McIntyre (1982) also carried out a laboratory experiment in which he systematically manipulated the availability of a well specified decision-calculus model. The results of this study, contrary to the results of Chakravarti et al. (1982), indicate that well specified decision-calculus models can be expected to improve unaided decisions, at least for problems that involve constrained budget allocations in simple stable environments. In this section we will elaborate on the issue of the effects of marketing management support systems.

The effects of marketing management support systems can be considered to be dependent on four sets of variables: the characteristics of (1) the marketing management support system, (2) the marketing decision-maker, (3) the marketing problem, and (4) the decision-environment. These four classes of variables are expected to influence the effects of a marketing management support system. Not only directly but also in interaction with each other. This means that the effects of a certain type of MMSS are expected to be different for decision-makers with different characteristics and in different decision-environments.

In an experimental laboratory study in which both 80 "real-life" marketing decision-makers and 160 students participated we conducted research on the factors influencing the effects of MMSS (for an extensive discussion of the way the research was conducted and its results see van Bruggen (1992, 1993)). This experimental study, was conducted in the MARKSTRAT-environment (Larréché and Gatignon, 1990). In this environment users had to make marketing-mix decisions (e.g. the level of advertising budget, the price, the number of sales people etc.) in a number of consecutive periods.

As we have seen in Section 2 and 3 different types of MMSS can be distinguished. We were interested in the question in which way specific characteristics of marketing management support systems would influence the effects of these systems. Therefore we studied the effects of three different marketing management support systems: two MDSS and one MKBS. Marketing decision support systems support decision-makers in the design and the choice phase (Simon, 1977) of the decision-making process. In these phases marketing decision-makers generate possible courses of action and, after this, choose the best action.



The two MDSS offered the opportunity to perform "what-if" analyses and in this way investigate the consequences of different marketing programs on sales. The two MDSS differed from each other with respect to the predictive power of their simulation models. The first MDSS, which was called the "high-quality" MDSS, showed a mean absolute percentage error (MAPE) in its forecasts of 3%, while the second system, the "medium-quality" MDSS showed a MAPE of 23%.

Finally, we studied the effects of a marketing knowledge-based system which performed qualitative analyses to detect changes in the market and to find possible causes of these changes. This MKBS supported decision-makers in the intelligence phase of the decision-making process (Simon, 1977). In this phase the decision-makers look for situations in the market which call for action.

We investigated the effects of the three MMSS on the market share obtained in the MARKSTRAT world as an objective performance measure, the amount of decision-making time needed to make the decision and the confidence decision-makers showed in the decisions they made.

The results of our experiment showed that both the high quality MDSS and the medium quality MDSS were effective. It appeared that users of the two systems significantly outperformed unaided decision-makers. On average the market share in the MARKSTRAT-world, of the users of the high-quality MDSS was 5.4 percentage-points higher than the market share of the unaided decision-makers, while the market share of the users of the medium-quality MDSS was 2.5 percentage-points higher compared to the unaided users. Between the results of the decision-makers using the two types of systems also a significant difference existed. Decision-makers using the high-quality MDSS significantly outperformed the users of the medium-quality MDSS. The decision-makers did not perceive the high-quality MDSS as more useful for improving the quality of their decisions than the medium-quality MDSS, though. We found the MKBS only to be significantly effective in the beginning of the experiment. Decision-makers using this system than outperformed the unaided decision-makers. In the later periods the difference was not significant any longer. A possible explanation for this finding was that in the beginning the environment was new and relatively unstructured to the decision-maker. In such a situation a system which guides the user in his monitoring and diagnosing activities can be effective. In the later periods, when the decision-maker becomes experienced he can perform the monitoring and diagnosing activities himself and the added value of the MKBS decreases.

Our results imply that for marketing-mix decisions, like the ones in the MARKSTRAT world, systems for fine-tuning decisions can be effective, even when the quality of the simulation models is not perfect. Systems which help the user with performing monitoring and diagnosing activities by qualitative reasoning are probably most effective when the situation is relatively new and unstructured to the decision-maker.

There are many different types of marketing decision-makers with different analytical styles. We were interested in the question whether one type of decision-maker would be better able to benefit from the use of an MMSS than another type. Therefore, we investigated whether the analytical capabilities of the marketing decision-maker would

influence the effects of the MMSS. This turned out to be the case. The high-quality MDSS, as an analytical decision-aid, was able to compensate for a lack of analytical capabilities of the decision-maker using the system. Without using the MDSS the difference between non-analytical decision-makers was larger than when both groups of decision-makers were using the MDSS. This effect only appeared in the case of the students while it did not for the real-life marketers. On average the analytical capabilities of the real-life marketing decision-makers were lower than those of the students. Probably, for a compensating effect to appear, the marketing decision-maker need to have certain minimum analytical abilities. When his analytical abilities do not exceed this threshold level, the MDSS is not able to compensate for a lack of analytical abilities any longer. Like we expected, individual differences thus do influence the effects of the use of MMSS.

Many marketing decisions have to be made under a considerable amount of time-pressure. We were interested whether under such conditions the use of MMSS would still be effective. For this we looked at the influence of the degree of time pressure. It appeared that making decisions while using an MMSS took more decision-making time than making the decisions without the help of an MMSS. Therefore, it is not surprising that most of the time decision-makers benefitted more from the use of MMSS under low time pressure than under high time pressure. Especially in the case of the high-quality MDSS, when decision-makers were able to increase their market share with a large amount by using the system, time pressure negatively influenced the results of the marketing decision-makers. However, even under high time pressure the decision-makers still benefitted from the use of MMSS.

As already described above the use of MMSS does not only result in a better performance it also results in an increase in the amount of decision-making time, needed to make a decision. For all three MMSS we found that the decision-makers using these systems needed more time for making their decisions than decision-makers who made their decisions without the help of an MMSS. Even in the case of the MKBS, which was only effective in the first time period, users of it needed more decision-making time in all of the four periods. However the average increase in the amount of decision-making time was relatively small: 6%, 8% and 13% for the MKBS, the medium-quality MDSS and the high-quality MDSS respectively. It seems that at the cost of a relatively small increase in the amount of decision-making time, decision-makers can increase their market share significantly. In "real-life" situations decision-makers have to weigh out whether the benefits of using the MMSS are larger than the costs of using more decision-making time.

Besides the effects on the "objective" performance of the marketing decision-maker as measured by the level of the market share, we also studied whether the use of the MKBS influenced the confidence decision-makers showed in their decisions. It appeared that even if MMSS increased the market share of decision-makers it did not have very much influence on the decision confidence. We saw that the MKBS which caused only an increase in the market share in period 1, resulted in the largest increase in decision



confidence when compared to the two types of MDSS. Since the MKBS assisted the decision-makers in analyzing the environment and diagnosing problems, it can be inferred from this finding that insight in the working of the market might be more important for building up decision-confidence than following the recommendations of a "black-box" simulation model even if the latter causes a higher increase of the market share.

Summarizing we can state that the use of marketing management support systems helps marketing decision-makers to perform better. The magnitude of the increase in performance is dependent on the characteristics of the specific decision support the MMSS offers and in the case of an MDSS on the quality of the simulation models. Furthermore, to benefit from using MMSS, the analytical capabilities of the marketing decision-makers should be above a minimum threshold level. Finally, the degree of time-pressure also influences the way decision-makers benefit from using MMSS. Although the decision-makers even benefit under high time pressure, under low time pressure they are able to take more advantage of the use of MMSS. Besides increasing the performance using MMSS also results in an increase of the amount of decision-making time. Finally, the influence on the evaluation of the decisions made is only small and sometimes even nonexistent.

## 5. PERSPECTIVES

It seems natural to take the four components framework of Figure 1 to structure the discussion about the perspectives for MMSS. This will be the first approach followed in this section. Secondly, we will consider what can be learned for the implementation of successful MMSS from the results of the studies discussed in Section 3 and Section 4 of this paper.

### *Developments in the Components of MMSS*

First of all, it seems a safe prediction that developments in *information technology* will continue to drive the development towards more powerful, more user-friendly and more effective MMSS. Computers become increasingly easy to communicate with (very important for marketing managers who usually are no computer freaks). Also through multimedia facilities, in the future a marketing manager will not only use a computer for presenting figures and graphs, but also for pictures and sound. For example, when analyzing the effect of a specific commercial or advertisement, the future marketing manager will be able to see (and hear) this very commercial with the push of a button. Also a marketing manager will be able to "watch" from behind his desk displays in supermarkets, product packages etc. These extensions will make MMSS much more a part of the existential world of the marketing manager.

Also developments in software technologies will have important consequences for MMSS. For example object oriented programming will make it much easier to connect all kinds of different marketing events (e.g. with respect to products, brands, competitors, retail chains) with each other.

Furthermore, there are the ongoing developments in AI. So-called production systems

technology, the basis of (rule-based) expert systems, are becoming popular in marketing already (Wierenga, 1992). We will also see frame-based systems (using object-oriented technologies) and neural networks. All this will dramatically enhance the knowledge processing capabilities of MMSS.

*Marketing data* will become available in ever larger quantities (stimulated by new technologies such as barcode scanning), and these enormous amounts of data will make it necessary to develop intelligent systems that carry out monitoring and analysis tasks (MKBS).

Over the years there has been a steady development in the *analytical capabilities* that are available for the marketers. Statistical procedures range from simple regression to multivariate analysis, causal modelling (LISREL), logit models and latent class analysis. Also there is continuous progress in the development of marketing models for the different functional areas of marketing, and overall marketing mix models (Lilien, Kotler and Moorthy, 1993).

Maybe the most spectacular developments will take place in the area of *marketing knowledge*. In the coming years the techniques and methodologies developed in AI will be applied to marketing, to capture marketing expertise and knowledge from practising marketers and put this into knowledge-based systems. It will also be attempted to develop MKBS which can learn from experience. Here techniques like neural nets and Case Based Reasoning (Kolodner, 1991) can be applied. It is still too early to predict the impact of this but the potential appears to be great.

One result of these developments are so-called hybrid systems in marketing: systems that combine data and analytical capabilities of conventional MDSS with the qualitative knowledge processing capabilities of MKBS (Wierenga, Dalebout and Dutta, 1992 and Dutta, Wierenga and Dalebout, 1993).

So all the components of MMSS are on the move, which implies that the next generation will be substantially different from the current MMSS.

### *Conditions for Successful Implementation of MMSS*

The numbers in this paper indicate that there is an enormous potential to improve marketing decision-making in companies by means of marketing decision support systems. The penetration of MDSS in companies is still low (see Section 3), while the use of MMSS can increase the effectiveness of decision-makers (see Section 4). What can be learned from the study on adoption and satisfaction?

First of all the adoption of MMSS tends to go together with a more developed marketing infrastructure (marketing departments and marketing research departments) and marketing procedures (use of an annual marketing plan for example). In other words it does not make much sense to install MMSS if a company is not using basic marketing principles.

Secondly, support of topmanagement and of colleagues in the development and implementation of an MMSS are key factors. So the environment of the marketer has to be conducive for an MMSS.

Thirdly, the adoption of MMSS can be fostered by communication: word-of-mouth through colleagues, presentations, showing successful MMSS in other companies, etc. In the fourth place participation of the marketing people in the development and

implementation of an MMSS is critical for satisfaction and use. Although this does not come as a surprise, it is a surprise that in practice in over half of the cases marketing does not play a major role in this process. This seems to lead to overly simple systems, which are not liked by the younger and higher educated marketers.

Generally speaking more sophisticated and more flexible (adaptable) systems lead to a higher level of satisfaction.

Finally, it is also important to have MMSS which the marketer can use through direct interaction with the system (not through intermediaries such as research assistants).

#### *Conditions for Effective Use of MMSS*

Based on the results in Section 4, we can state that to increase the effectiveness of MMSS it is not only important to develop the right systems but also look at the characteristics of the decision-makers using these systems.

MDSS are effective but the amount of improvement in the results is dependent on the quality of the simulation model(s) in the MDSS. Therefore, it is profitable to put effort in the development of better predicting marketing models.

MKBS, for performing qualitative monitoring and diagnosing tasks, seem to be helpful for decision-makers to structure the decision-environment they are operating in. Therefore, MKBS may be very useful as a tool for training new and inexperienced decision-makers. This way they can discover relationships between key variables in a market and will become familiar with this market very quickly. By doing this, new and inexperienced marketing decision-makers can be effective immediately. As we saw MKBS which only perform qualitative monitoring and diagnosing tasks may be less effective in situations where decision-makers are familiar with the market. Maybe in such cases systems, which also recommend which actions to take given a certain situation, are more effective.

With respect to the characteristics of the marketing decision-makers, when providing them with MMSS one should take account of their analytical capabilities. In the case of decision-makers with very low analytical capabilities, the benefits of using MMSS may be very small and given the high investment costs not profitable. This implies that to further increase the effectiveness of MMSS in selecting personnel for making marketing-mix decisions one should take account of their analytical capabilities. These analytical capabilities should exceed a certain minimum threshold-level.

#### *In Conclusion*

We are only observing the beginning of Marketing Management Support Systems, both with respect to their sophistication and to their adoption in companies. New scientific and technological insights will lead to increasingly better systems. Marketers will more and more discover the value of these systems and implement them in their companies. The success of MMSS can be considerably improved by taking into account the critical factors dealt with in this paper. The rest of the nineties will observe a quickly accelerating growth of Marketing Management Support Systems. The take off has begun!

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