CHAPTER ONE

Introduction and Overview

1.1 INTRODUCTION

Since the early 1960's the literature of marketing science has been enriched by a great number of publications on the subject of marketing decision-aids. Most of this literature focuses on the *development* of these decision-aids, more specifically on marketing modelling. The works of Montgomery and Urban (1969, 1970), Lodish (1971), Little (1975), Naert and Leeflang (1978) and Lilien, Kotler and Moorthy (1992) are typical of this category of literature.

Less attention in the literature of marketing science has been paid to the issue of whether the *use* of these decision-aids really helps decision-makers in improving their *performance*. Also it is not clear which factors influence the magnitude of the improvement. Since marketing decision-aids aim at increasing the effectiveness of marketing decision-makers these issues are important.

So far, the research that has been conducted on the effects of marketing decision-aids has extended to both theoretical and empirical research. Most of the *theoretical* research focuses on identifying the factors which are important for a successful *implementation* of marketing decision-aids. Although Lilien, Kotler and Moorthy (1992) acknowledge that the value of models in marketing should be measured by their *impact* on organizational effectiveness, in most of the research the implementation of a decision-aid is conceived of as successful by its mere *use*. Not much attention has been paid to the question of whether or not it improves the *performance* of a marketing decision-maker. The emphasis in theoretical research is on the relationship between the characteristics of the decision-aids and their successful implementation. Little (1970), for example, suggests a number of criteria a decision-aid should meet, in order to be really used. Larréché and Montgomery (1977) relate the likelihood of model acceptance to model characteristics; while other authors pay attention to the role of organizational and decision-maker characteristics. An example of the latter is to be found in Schultz and Slevin (1972) who propose a theory of behaviourial model building. According to this theory the projected probability of success of a marketing decision-model depends upon how well the model represents a real market ("market validity") and also upon how compatible the model is with the organization using it ("organizational validity").

In this study the emphasis is on the *effectiveness* of marketing decision aids, i.e. how far a marketing decision aid improves the *performance* of a marketing decision-maker.

The *empirical* research conducted so far, consists of a number of more or less "ad-hoc" studies, which are based neither on a broader framework nor on a theoretical model. The two best-known studies on the effectiveness of marketing decision-aids are those performed by Chakravarti, Mitchell and Staelin (1979) and McIntyre (1982).

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 indicates 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 indicate, contrary to the results of Chakravarti et al. (1979), 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.

Of the studies conducted so far, McIntyre's is probably the most extended example on the effectiveness of marketing decision-aids. This study takes into account the influence of the characteristics of the marketing decision-maker, the characteristics of the problem and the characteristics of the decision-environment on the effectiveness of one marketing decision-aid. Furthermore, the effects of the marketing decision-aid on three categories of dependent variables are investigated, i.e. measures of outcomes, courses of action and measures of decision-conviction. The study's major shortcoming is that no attention is paid to the actual use of the decision-aid nor to the relationships between the dependent variables. Furthermore, the experimental environment is relatively simple. A marketing simulation is used which is static across periods, contains no competitive reactions and where no carry-over effects appear.

An overview and evaluation of the empirical research on the effects of marketing decision-aids will be presented in § 2.3.2. From that review we conclude that most of the studies on marketing decision-aids investigate the effects of a relatively small number of variables. A number of studies go no further than the effects of the *availability* of marketing decision-aids. In few studies the influence of other independent variables on the relationship between the availability of the marketing decision-aid and its effectiveness is considered. As to that the study of McIntyre (1982) is an exceptional case because it also studied the effects of variables like problem size, and the decision-makers mathematical ability and cognitive style.

The number of dependent variables in the studies is relatively small and the specific dependent variable(s) chosen, differ across studies. Some studies focus on factors affecting the use of a decision-aid while others investigate their effectiveness, this notwithstanding the fact that in the theoretical studies not much attention was paid to this last variable (the effectiveness). Relationships between the various dependent variables, for example between use and effectiveness of marketing decision-aids, are not usually investigated.

Although in most studies data are collected over several periods of time, none of the studies investigated whether changes in one variable cause changes in other variables in following periods. That is, all the studies are *factor* studies rather than *process* studies.

The experimental tasks used in the studies are relatively simple. As a consequence, the marketing decision-aids studied so far are relatively small systems, mostly designed for the support of decisions on only one marketing-mix variable. Furthermore, no more than one marketing decision-aid was studied in any of the studies.

Subjects in the studies conducted so far have been either students *or* professional marketing decision-makers. No study involved the participation of *both* students *and* professional marketing decision-makers.

From here onwards, the marketing decision-aids will be referred to as Marketing Management Support Systems (MMSS[1]). These systems are defined in more detail in Section 1.2. The goal of the present study is to carry the insight into the effects of MMSS beyond the current state of affairs. This way it has to become more clear which factors influence the use and effectiveness of MMSS. This insight is important for the adoption and diffusion of *effective* MMSS.

For this purpose our study has accommodated for a number of the limitations in the studies on the use and effectiveness of MMSS reported so far. Unlike these earlier studies we have investigated the effects of *three different* MMSS (rather than one) in *one* decision-environment.

Instead of the relatively simple decision-environments used in earlier studies, we have used a more complete and complex one. The decision-environment we have used, i.e. MARKSTRAT (Larréché and Gatignon, 1990), is one in which decisions have to be made on several interacting marketing-mix variables, rather than on only one variable. Furthermore, this environment is a dynamic and competitive one, different from the one used by McIntyre (1982).

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[1] 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 (see Section 1.2) are used in the same way.

We have not only investigated the effects of three different marketing decision-aids but we have also studied the effects of the marketing decision-maker (like marketing decision-making experience and cognitive style) and marketing decision-environment variables (like time-pressure). Our aim was to gain insight into the effects of the different MMSS under different conditions. Furthermore, relationships between the different variables have been investigated across periods of time to study whether these relationships change over a certain period. Our study thus also contains an analysis of the *process* of marketing decision-making using a marketing decision-aid in addition to an analysis of the factors influencing the effectiveness of MMSS.

Until now, no attention has been paid to the relationship between the actual use of the MMSS and its effectiveness. Since such a relationship is to be expected, we have investigated it in this study.

Finally, in some of the studies conducted so far, students participated as subjects. In other studies, professional (real-life) marketing decision-makers participated as subjects. In our study not only students but also professional marketing decision-makers have participated as subjects.

The study starts with the development of a research model that describes the way MMSS influence the performance of a marketing decision-maker. This model functions as the framework for the study. In developing the model we have used the results of theoretical and empirical research on both the use and the effectiveness of marketing management support systems and (General) Information Systems. In our model we assume the performance of a marketing decision-maker, using an MMSS, to be dependent on four classes of variables: (1) characteristics of the marketing management support system, (2) characteristics of the marketing decision-maker, (3) characteristics of the marketing problem, and (4) characteristics of the decision-environment. In each of these four classes, specific variables have been selected.

The effects of three different MMSS have been studied in three experiments. By testing the relationships between the independent variables and the performance variables, we can gain insights into the question as to whether the use of MMSS improves the performance of marketing decision-makers and if so under which conditions.

1.2 MARKETING MANAGEMENT SUPPORT SYSTEMS

Three different types of computerized marketing management support systems (Wierenga and van Bruggen, 1992a,b) can be distinguished, i.e. marketing information systems (MKIS), marketing decision support systems

(MDSS) and marketing knowledge-based systems (MKBS). This section is devoted to a description of these systems. In this study we focus on the effects of the use of MDSS and MKBS.

Marketing Information Systems

Marketing Information Systems (MKIS) are the result of the application of the concept of Management Information Systems to the marketing field. The aim of an MKIS is to provide marketing decision-makers with information. Therefore an MKIS consists of a data base (with marketing data) and the ability to apply statistical analyses to these data. This statistics bank provides the user of the system with a number of statistical techniques to transform the data into information.

Marketing Decision Support Systems

Marketing Decision Support Systems (MDSS) are the result of the application of the concept of Decision Support Systems to the marketing field. 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 thus differs from an MKIS in that it contains a model base in addition to both the data base and the ability to apply statistical analyses. Therefore an MDSS can be conceived of as an extension of an MKIS. The model bank, in particular, provides the system with the capability of assisting directly in decision-making. This model bank can contain three major classes of quantitative models: descriptive, predictive and normative models. Descriptive models are concerned with providing detailed and accurate representations of phenomena. Predictive models are used to forecast the system's future behaviour. Normative models yield solutions or recommend decisions to solve problems (Montgomery and Urban, 1969). 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.

Marketing Knowledge-Based Systems

Marketing Knowledge-Based Systems[2] (MKBS) are the result of the application of AI-technology to the marketing field. 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, structured, programmable and operational and tend to be problems that are not dealt with by the marketing manager him/herself, but tasks that are usually delegated.

An important difference exists between MKIS and MDSS on the one hand and MKBS on the other. While MKIS and MDSS are focused on the manipulation of quantitative data, MKBS are focused on the manipulation of (mainly qualitative) knowledge.

1.3 RESEARCH QUESTIONS

With respect to the use of marketing management support systems three research questions have been formulated. The first question we have asked is *whether the use of a marketing decision support system increases the effectiveness of marketing decision-makers, and if so, under which conditions.* To answer this question, we have investigated the effects of using an MDSS on the performance of marketing decision-makers. We have also studied the amount of decision-making time they use and the confidence shown in their decisions. We further study whether the effects of the MDSS differ for (a) experienced vs. inexperienced decision-makers, (b) for analytical vs. non-

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[2] 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.

analytical decision-makers, and (c) for high time-pressured vs. low time-pressured decision-makers.

In most empirical studies the effects of only one type of MMSS were studied. The quality, of the different MDSS studied, probably, differed. We have no insight into the effects that these quality differences may have had on the results of the empirical studies. Here, we are interested in the question whether the results of using an MDSS are dependent on its quality (the quality of the MDSS was operationalized as the predictive power of its forecasts). Therefore the second question we have asked is *whether the effects of the use of a marketing decision support system are dependent on its quality, and if so, under which conditions*. To answer this question, we have compared the results of decision-makers using a high-quality MDSS (this is the MDSS referred to so far) with the results of decision-makers using a medium-quality MDSS and also with the results of unaided decision-makers. We have studied whether the effects of the quality of the MDSS differ for (a) analytical vs. non-analytical decision-makers, (b) for decision-makers with a positive attitude towards MDSS-in-general vs. decision-makers with a less positive attitude, and (c) for high time-pressured vs. low time-pressured decision-makers. Furthermore, we also study whether the quality of the system affects its use and the way it is evaluated.

Both the first and the second question focus on systems that help the decision-makers with "designing" (Simon, 1977) marketing decisions. Marketing knowledge-based systems can be used to help marketing decision-makers in monitoring and diagnosing phenomena in the market (called the "intelligence phase" of the decision-making process by Simon). We are interested in the way these systems influence the performance of marketing decision-makers. Therefore, the third question we have asked is *whether the use of a marketing knowledge-based system increases the effectiveness of marketing decision-makers, and if so, under which conditions*. Therefore, we have studied the effects of a system which helps the marketing decision-maker, in monitoring and diagnosing market research data, by means of qualitative reasoning: an MKBS. Here again we have investigated the effects of the MKBS on the performance, the decision-making time and the decision-confidence. We study whether the effects of the MKBS differ for (a) analytical vs. non-analytical decision-makers, (b) for decision-makers with a positive attitude towards MDSS-in-general vs. decision-makers with a less positive attitude, and (c) for high time-pressured vs. low time-pressured decision-makers.

We are not only interested in the effects of MMSS at one point in time but also in the question as to whether the effects of MMSS change over a

number of periods of time (whether a *process* appears). Therefore, the effects of the use of the various MMSS are studied in several consecutive periods.

1.4 THE EXPERIMENTS

In this section we briefly describe the design of the three experiments. The detailed design of the experiments is described extensively in Chapter Three.

The research in this study was carried out using the experimental laboratory approach. This method was chosen because it allows the systematic manipulation of independent, experimental, variables and the control of other variables. This way the causal relationships between independent and dependent variables can be tested properly. Furthermore, the experimental approach makes it possible to make a number of observations over time. This provides the opportunity to study the *process* of decision-making by marketing decision-makers using a marketing management support system.

Whereas internal validity is a strong point in the experimental laboratory approach, external validity can be a problem. To overcome this problem the experimental environment had to correspond as much as possible with a real-world situation.

In this study MARKSTRAT, a marketing strategy game (Larréché and Gatignon, 1990), was used as the experimental environment. We opted for a marketing simulation game because, as Larréché (1987) states, simulations provide an attractive experimental setting for research. This attractiveness is a result of its ability to control the experimental conditions relatively easily, and its ability to explicitly consider the time dimension. We choose for MARKSTRAT because it reflects a situation that is representative for a real-life marketing situation. Research by Kinnear and Klammer (1987) shows that managers working in diverse industries believe that MARKSTRAT does reflect a real environment, useful for teaching and research.

MARKSTRAT was developed about fifteen years ago and was originally conceived of as a research environment for strategic studies in marketing. Apart from being a suitable research environment it became very popular as a classroom game in graduate and management-education programmes (Cook, 1987). However, MARKSTRAT has also been used a lot as a vehicle for research. Research conducted in the MARKSTRAT environment has been undertaken by Hogarth and Makridakis (1981, 1988), Ross (1987), Lant and Montgomery (1987), Cook and Page (1987), Fox Utsey (1987), Glazer, Steckel and Winer (1987) and Green and Ryans (1990). Recently, studies have been conducted by Curren, Folkes and Steckel (1992), Glazer Steckel and Winer (1992) and Lant (1992). This research was on issues like

the influence of decision-rules on decision-quality, the explanation of risk-taking behaviour and the formation of aspiration levels.

To our knowledge no research has yet been reported on the effectiveness of marketing management support systems conducted in the MARKSTRAT environment.

The participants in our study had to adopt the role of marketing decision-makers in the MARKSTRAT world. During sessions, which lasted about three hours on average, subjects had to make marketing decisions on two brands of a consumer durable good. These were decisions on marketing-mix variables like the advertising budget, the price and the distribution efforts. Decisions had to be made in four consecutive periods.

Twelve experimental groups were created: we varied the MMSS the decision-makers were provided with (no MMSS, high-quality MDSS, medium-quality MDSS and MKBS) and the amount of time-pressure (low vs. high time-pressure) the decision-makers had to operate under. Furthermore, the decision-makers were categorized according to their marketing decision-making experience (experienced vs. inexperienced). Each experimental group consisted of twenty subjects, resulting in a total of 240 (= 12*20) subjects.

Our subjects were 160 master level students in business administration or economics and 80 "real-life" marketing decision-makers. The number of real-life marketing decision-makers was smaller than the number of students because it was very complex and time consuming to recruit the experienced decision-makers. In Section 3.3, we discuss the consequences of this fact for the design of our experiment.

The students had all been involved in a substantial number of courses on marketing. The marketing decision-makers, who had various educational and industrial backgrounds, were all experienced in making marketing decisions, since this is the main part of their daily occupation. On average they had 7.9 years experience in a marketing function.

1.5 OUTLINE OF THE BOOK

This book consists of three parts. Part I (Chapters Two and Three) contains the theory and the design of the study. In Chapter Two, the research model is developed. This model describes the way an MMSS affects the performance of a marketing decision-maker. This research model provides the framework for the study. The model is based on both theoretical and empirical research, relating to the use and effectiveness of both marketing and general management support systems. This research is reviewed before constructing the model.

In Chapter Three, the design of the three experiments is presented. We describe the experimental environment, the way the variables are manipula-

ted or measured, the different marketing management support systems used in the study, and the experimental procedures that were followed. Furthermore, we discuss how the subjects evaluated the experiment.

Part II (Chapters Four, Five and Six) contains the empirical results. In Chapter Four, the results of the first experiment are presented. In this experiment we study the effectiveness of a marketing decision support system for 80 students and 80 "real-life" marketing decision-makers. This way we shall answer the first research question

Chapter Five contains the results of the second experiment. In this experiment we investigate whether the effectiveness of an MDSS is dependent on its quality. For this we compare the results of the availability of both a high-quality MDSS (this is the system of Chapter Four) and a medium-quality MDSS. By doing so we shall answer the second research question. In this experiment 120 students participate.

In Chapter Six, the results of the third experiment are presented. In this experiment we study the effectiveness of a marketing knowledge-based system (MKBS). This MKBS performs monitoring and diagnosing tasks by means of qualitative reasoning. By analyzing the results of the third experiment we shall answer the third research question. In this experiment 80 students participate.

Finally, Part III (Chapter Seven) contains the implications. In Chapter Seven, based on the major findings of the experiments, we formulate conclusions on the effectiveness of marketing management support systems. Furthermore, the influence on the effectiveness of MMSS, of the various variables investigated (e.g. marketing decision-making experience, analytical capabilities etc.) is discussed. Next, we discuss the implications of our findings for the use of MMSS in practice. We end Chapter Seven with discussing the implications of the results of our study for future research on the use and effectiveness of marketing management support systems.