

Decision Support Systems as the Bridge between Marketing Models and Marketing Practice

by Berend Wierenga

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.



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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 "mar-

keting 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" (Lillien, 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). Lillien 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.

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| <ul style="list-style-type: none"> • Higher quality marketing management support systems • More favorable user environments • The third marketing era • Customer relationship management (CRM) |
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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 practice¹. 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

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 from the system (Engelke and Simon 2007, section 5.1). 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 automatically 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.

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