Are Decision Support Systems helping Marketers?

A framework for analysis and a literature review

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Abstract

This article provides an overview and integrates relevant literature of empirical research of the effectiveness and efficiency of DSS for marketing. First we present a structural framework on how to analyze the different empirical studies. Then we summarize the outcomes. Finally we draw some conclusions and give some suggestions for further research.

Keywords: Performance modeling, Decision Support Systems, marketing

1. Importance of IT in marketing

Developments in computer industry, in the mid eighties, made it possible that several tasks could be carried out much more easily. Automating the collection and analysis of marketing information would result in timely marketing and sales decisions and their quality would be largely improved. Later on information technology also facilitated the automation of the sales and marketing support in a Management Information System. This would lead to improved efficiency of the marketing and sales staff.

Hardware en software costs continually decrease and the computer programs become more and more powerful. Its main barriers such as computer power (for PCs) and software compatibility have largely disappeared. However, does information technology provide the required return on investment? Which added value has been created by this new technology. How can answers to these questions be found.

Realizing the advantages of a DSS is difficult. Substantial productivity benefits such as cost reductions can be properly measured. It is evident that the use of a DSS also has 'soft' benefits. For example, it is reasonable to assume that this marketing tool is able to make more effective and better founded decisions, because marketers have information to their disposal that is more recent, more comprehensive and more reliable.

The importance of information in commercial processes is largely recognized. Unanswered remains the question to what extent information provided by the DSS can improve a marketer's performance.

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2. Advantages of DSS usage

Various authors have investigated the assumed benefits of DSSs. In their literature investigation Money, Tromp and Wegner (1988) have provided a reasonably complete overview of the advantages of usage of decision support systems e.g.:

1. Administrative advantages (time and labor savings),
2. More efficient use of management time,
3. Better decision making, handling more complex problems,
4. Better judgment of problems, superior trust in decisionmaking,
5. Better data usage (recency, accuracy, access and availability),
6. Better planning and control,
7. Possibility to research more alternatives,
8. Communication advantage.

3. Evaluation framework

One of the more useful frameworks for evaluation of DSS is put forward by Adelman and Donnell (1986). The design and evaluation stems from three interfaces (see figure 1):

1. The interface between DSS and the user (DSS/U), the question is which characteristics of DSS ease or limit the usefulness for the user?
2. The interface between the user (and DSS) and the Decision Making Organization (U/DMO). Does the DSS enhance the decision making process?
3. The interface between the organization and the environment (DMO/ENV) Does the use of DSS lead to better performance?

Wierenga and Van Bruggen (1994) acknowledge that implementation of information systems do not automatically lead to better decision-making. Effective decision-making is dependent on several factors e.g.:

1. personal characteristics,
2. DSS,
3. the type of (marketing) problem,
4. environment.

Every factor can again be broken down into several variables. Personal characteristics for instance in cognitive style, type of personality and demographic and situational factors. Wierenga and Van Bruggen distinguish within DSS 'hardware' and 'software' dimensions. The type of marketing problem can be subdivided into strategic, technical and operational problems. The environment can be divided into the internal (organizational) and the external (competitive) environment.

Kettinger et al. (1994) make two other additions to the characteristics of the framework, fundamental organizational characteristics like size, breadth of product line, position on the learning curve etc. and action strategy of the company in terms of risk handling, flexibility etc. Both factors have a pronounced effect on the success of DSS.

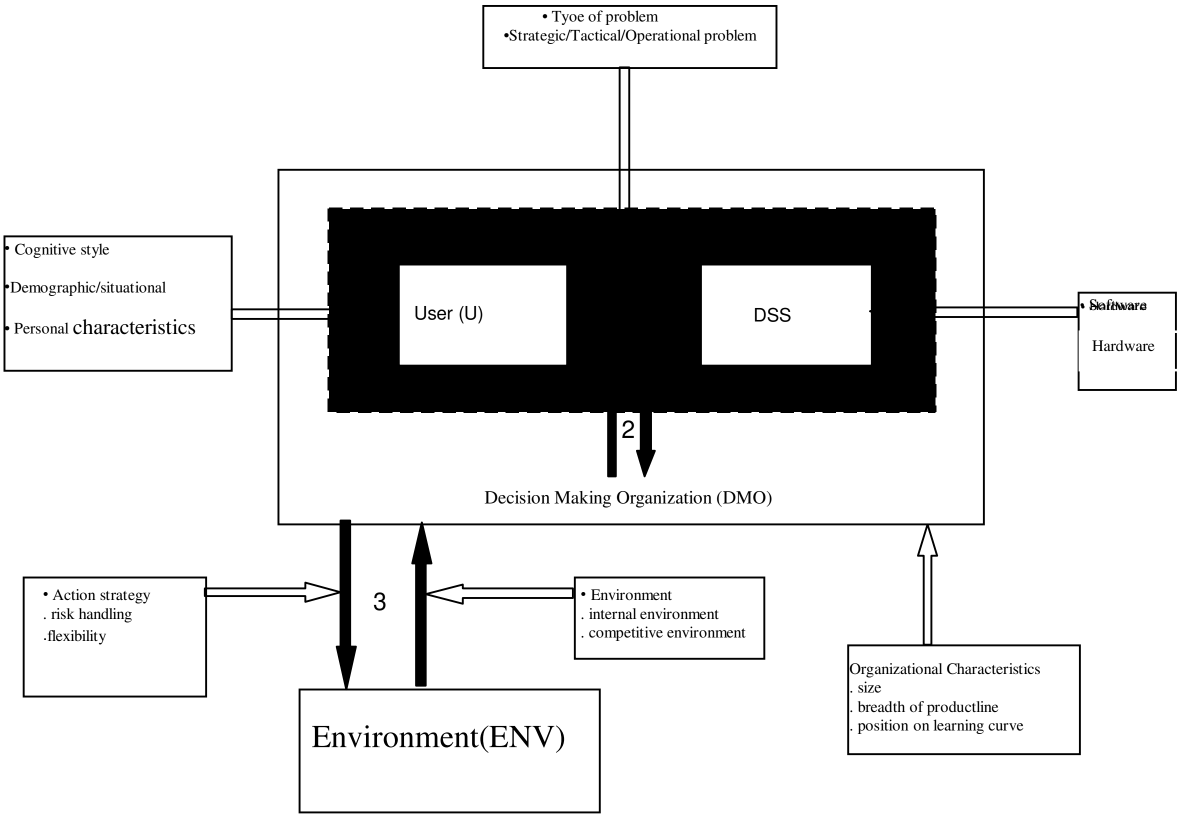

Figure 1. Overall framework

In figure 1 we have combined the contributions of the three above mentioned theoretical frameworks into one overall, all compassing framework.

4. Research methods

Adelmann and Donnell (1986) have defined three alternative types of evaluation procedures for DSS performance: subjective judgment, expert observation and objective measurement.

A subjective judgment requests from users to assess their experiences. In most cases this means that a user has to fill out a questionnaire. Expert observation also uses a subjective judgment, however in this case of non-participating observers and experts in the field of DSS to judge DSS users. Objective measurement is usually related to empirical experiments and comparison. Objective, empirical measurement is considered as the most reliable and consequently most preferred way to acquire data. Unfortunately, this is a very expensive method and in practice it is often selected for expert observation and subjective judgment.

In representing the results of the investigations to DSS performance, in each case we will report the method used. This will enable the reader to estimate such a method at its true value.

5. Research results

The results of the DSS studies found in literature are given again on the three interfaces of evaluation in our model.

On the first interface (1) *U/DSS* a number of studies have appeared, see table 1.

The use of a DSS by a marketer increases his time to come to a decision implying a decrease of his efficiency. As far as a the effectiveness of DSS usage by marketers is concerned DSS usage implies that various alternatives are taken into account and evaluated and, consequently, a better decision is made.

Table 1. Research into efficiency DSS/U

Author	Method	Criterion	Results
Ghani & Lusk(1982)	Lab exp.	Decision time	(-)
Benbasat & Dexter (1982)	Simulation	Decision time	(-)
Sharda et al (1988)	Lab exp.	Decision time	(0)
Van Bruggen et al (1994)	Lab exp.	Decision time	(-)
Webby, O'Connor (1994)	Lab exp.	Decision time	(+/0).

(0) No difference in required decision-making time.

(-) DSS usage was negatively correlated to the required decision-making time, there is a matter of an increased amount of required time

(+) DSS usage was positively correlated to the quality of the decision, there is a matter of a decrease in amount of time

Taking the marketer's confidence in his own decisions into account, it appears not to increase by using a DSS, see table 2.

Table 2. Research into effectiveness DSS/U

Author	Method	Criterion	Results
King & Rodriguez (1978)	Quasi-exp.	Qual. decision	(0)
Chakravarti et al (1983)	Lab. exp.	Qual. decision	(-)
Eckel (1983)	Lab. exp.	Qual. decision	(+)
Goslar et al (1986)	Lab. exp.	Qual. decision	(0)
Aldag & Power (1986)	Lab. exp.	Qual. decision	(0)
Cats et al. (1987)	Lab. exp.	Qual. decision	(+)
Sharda et al. (1988)	Lab. exp.	Qual. decision	(+)
Chu & Elam (1988)	Lab. exp.	Qual. decision	(0)
Sainfort et al. (1990)	Lab. exp.	Qual. decision	(+)

(0) No difference between quality of decision-making.

(-) DSS usage was negatively correlated to quality of decision-making.

(+) DSS usage was positively correlated to quality of decision-making.

Also some researchers have investigated the effects of the presentation of information on the quality of decisions, see table 3.

Based on these studies we may deduce that the presentation of information to the marketer has some positive influence on the quality of the decision made. This depends, however, on the purpose of the information. Furthermore, it seems that the presentation of information effects the time to make a decision, but studies do not explicitly point in this direction.

For interface (2), *(U-DSS)/DMO* literature provides hardly any research mentioning the benefits of DSS in an organization. Michelman and Kim (1990) report about a better performance of enterprises with an integrated system. Based on this study it is impossible to conclude about the contribution of a DSS to the performance at this point.

Table 3. Research into effectiveness DSS/U

Author	Method	Criterion	Results
Ghani & Lusk (1982)	Lab. exp.	Quality decision	(0)
Ghani & Lusk (1982)	Lab. exp.	Quality decision	(0)
Dickson et al. (1986)	Lab. exp.	Quality decision	(0).
Liang (1986)	Lab. exp.	Quality decision	(+)
Jarvenpaa (1989)	Lab. exp.	Quality decision	(0)

(0) No difference between quality of decision-making.

(-) DSS usage was negatively correlated to quality of decision-making.

(+) DSS usage was positively correlated to quality of decision-making.

Concerning interface (3), *DMO/ENV*, effectiveness is a combination of the quality of a decisions made, see also the effectiveness of DSS/U in table 2 and 3). In table 4 the studies are presented that have investigated the effectiveness benefits of DSS usage related to the environment.

The studies concerning the effectiveness of DSS usage clearly demonstrate that this results in an increase of the profit at the level of the organization.

Table 4. Research into effectiveness DMO-ENV

Author	Method	Criterion	Results
Chakravarti et al (1979)	Lab. exp	Profitability	(-)
Benbasat & Dexter (1982)	Simulation	Profitability	(+)
McIntyre (1982)	Simulation	Profitability	(+)
Eckel (1983)	Lab. exp	Profitability	(+)
Aldag & Power (1986)	Lab. exp	Profitability	(0)
Srivasan & Kaiser (1987)	Field study	Profitability	(-)
Sharda et al (1988)	Lab. exp	Profitability	(+)
Moriarty (1989)		Profitability	(+)
Van Bruggen et al. (1994)	Lab. exp	Profitability	(+)
Webby/ O'Connor (1994)	Lab. exp	Profitability	(0)

(0) No difference between quality of decision-making.

(-) DSS usage was negatively correlated to quality of decision-making.

(+) DSS usage was positively correlated to quality of decision-making.

6. Characteristics

Implementation of an information system does not automatically lead to an increase of the performance of the decision-maker. As stated before, the performance depends on a number of factors:

1. the marketing decision-maker or the characteristics of the individual,
2. the DSS,
3. the type of marketing problem,
4. the environment,
5. organizational characteristics,

6. the action strategies of the enterprise.

Table 5. Research into determinants of DSS performance

Author	Method	Criterion	Results
Zmud (1979)		Characteristics	Better trained DSS users will use a DSS more often. These users will be more dissatisfied about DSS
Morrison (1983)	Field-study	Characteristics	The positive perception of a person about the impact of a DSS determines the use.
Davis & Elnicki (1984)	Lab experiment	Characteristics	Cognitive styles of users were responsible for the difference in performance
Wafa (1986)	Field-study	Characteristics	Years of experience with DSS determines use and satisfaction.
Sharda et al (1988)	Lab experiment	Characteristics	DSS users knowledge of a DSS is correlated with DSS performance
Udo & Guimaraes (1994)	Field-study	Characteristics	Users experience and attitude are positively correlated with DSS performance.
Van Bruggen et al (1994)	Lab experiment	Characteristics	Experienced decision-makers need less simulations to come to the same results. Analytic as well as non-analytic users can benefit from DSS.

Table 6. Research into determinants for DSS performance

Author	Method	Criterion	Results
Cheney et al. (1986)	Field-study	Enterprise	Significant aspects are the position of the manager and the structure of his task
Ghoshal et al. (1986)	Lab experiment	Enterprise	Lack of training in DSS use increases the amount of evaluated alternatives, but has no further influence.
Lind et al. (1989)	Field-study	Enterprise	Organisation-structure is more important than size
Watson (1989)	Field-study	Enterprise	No specific relation between and DSS efficiency
Udo & Guimaraes (1994)	Field-study	Industry	The strategic position of an enterprise is the most important determinant for DSS performance
Udo & Guimaraes (1994)	Field-study	Enterprise	Enterprise-support and quality of training have influence on DSS performance

We will restrict ourselves to a brief discussion of the results of the investigations into these characteristics. For a brief survey we refer to table 5 and 6.

Ad 1. Knowledge of the DSS and experience with DSS usage will positively affect the user's performance. It seems that experienced decision-makers evaluate less alternatives in order to get to a similar performance.

Ad 2. The few studies into this relation indicate that the quality of the DSS improves the performance.

Ad 4. It seems that the support of the enterprise and the quality of the DSS training hardly affects the user's performance. The number of evaluated alternatives will increase if an adequate training is lacking.

7. Evaluation of existing research

Considering the literature in the field of the performance of DSS we will have to join the conclusions of Benbasat and Nault. The studies into DSS performance generally lack an adequate, theoretical basis. The variables examined seem to be selected more based on the concern of the investigators than that they are part of a well-structured research plan.

A number of research studies have appeared that broke with this kind of tradition. Udo and Guimaraez (1994), Wieringa and Van Bruggen (1994) and Webby and O'Connor (1994) use a well-structured theoretical frame for their studies.

Based on the presently available studies carried out into DSS performance a few cautious conclusions may be drawn. It should be noticed, however, that studies that have investigated the same interface sometimes contradict each other. This is caused by the chosen characteristics of, for example, the organization, the users, the DSS, etc. in the subsequent studies.

In brief the results are as follows:

Interface	**Efficiency**	**Effectiveness**
(1) U-DSS	Decision time (+)	Quality decision (-)
(3) DMO-ENV		Profit (+)

Yet it is disappointing that no unambiguous conclusion can be drawn, despite the large number of studies into DSS performance. Although there seems to be found some agreement on the theoretical basis, from the above survey it may be concluded that a lot of work still has to be done into DSS performance. For example, too few research studies have been carried out that have investigated the improvement of the internal communication by DSS usage.

Furthermore, there is an increasing need to well-structured research into the effect of action strategies and organizational characteristics on DSS performance. As early as 1985, Porter showed that the enterprise structure directly affects the IT performance in an organization. Unfortunately, this has only been one of the few remarks in this direction. Although DSS performance must only be evaluated on three interfaces, many variations with regard to the characteristics are possible. For this a structured approach is indispensable.

8. Conclusions and further research

The state of the art concerning the measurement of the contribution to an improvement of the performance is lamentable. Useful literature in this field dates from the mid eighties. Concerning DSS implementation in the organization it seems that the 'product champion' has taken over the role of the hobbyist in those days.

In the field of research a turnaround can be noticed. This opinion is based on articles in the field of DSS performance. In this article we have already given a useful evaluation framework for measuring the DSS performance. It is the task of researchers to further provide the missing pieces. Both in research and in practice there is an apparent need to innovative methods and techniques.

At this moment too little research has been carried out into the effect of organizational characteristics (structure), action strategies and environmental factors on the performance of the

DSS. Maybe a series of case studies could provide a better understanding of these factors. Further, there is a need of research into the effect of the use of unambiguous information in the planning process. In theory and in practice there is a high degree of agreement with regard to the contributions of DSS usage for the marketer: time benefits in accessing information, uniformity of information and an improved understanding of the own organization and market position.

Yet, in practice there is an absence of a well-structured evaluation method. As a consequence of this, managers react in the sense that '*no objective measures can be made of the value of DSS investments*.'

Quite often, the DSS benefits are assumed to be true without a critical assessment of its contribution. An example is the time benefit to access the information. In this case, one easily passes over the possibility of a surplus of information. For example, research studies indicate that marketers using a DSS need more time to come to a decision.

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9. Literature and references

The tables in this article are based on reviews by Benbasat & Nault (1990), Money et al (1988), Sharda et al (1988), Udo and Davis (1992) and Webby et al (1994) and literature in the list below.

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