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Decision Support Systems

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Abstract – Decision support systems are interactive, computer-based systems that aid users in judgment and choice activities. They provide data storage and retrieval but enhance the traditional information access and retrieval functions with support for model building and model-based reasoning. They support framing, modeling, and problem solving. Typical application areas of DSSs are management and planning in business, health care, the military, and any area in which management will encounter complex decision situations. Decision support systems are typically used for strategic and tactical decisions faced by upper-level management decisions with a reasonably low frequency and high potential consequences in which the time taken for thinking through and modeling the problem pays off generously in the long run.

Keywords: Computer, Functions, Problem, Decision, Support, Systems, Information, Business, Dsss, Health Care, Activities, etc.

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INTRODUCTION

The concepts of Decision Support Systems (DSS) were first introduced in early 70s under the term management decision systems. Initial advances in this area took, by and large, the form of specific DSS applications developed in various organizations. These systems were primarily designed and developed to meet specific organisational needs and were meant to support some decision making activity [1].

Decision problems can be characterized on two dimensions, viz. degree of structured ness and the organisational level addressed. The degree of structured ness of a decision problem can be expressed as:

a) Structured,

b) Semi-structured, or

c) Unstructured.

Structured decision problems are well-defined with respect to the identification of goals and algorithms or procedures, and problems of this kind are amenable to analytical models. Proven techniques such as Management Information Systems (MIS)/ Operations Research (OR)/ Management Science (MS) can be applied to these. Further, decision making in structured problems can be automated to a large extent. Examples under this category include resource allocation, location-allocation, and assignment problems at lower organisational levels [2]. On the contrary, no algorithms or procedures exist for unstructured problem solving and they require a good amount of human intelligence. In this class of problems it is almost impossible to provide any worthwhile support in decision makings. The problems of interest, therefore, are the semi-structured problems which require a combination of formal and informal procedures for solving them. Since this class of problems cannot be automated completely, it is a good area for systems based on human-computer interaction in which the computer takes over the part of the problem that can be automated and the decision maker controls the remaining. On the organisational dimension, the decision problems can be classified under strategic, tactical and operational levels with strategic level at the top of the hierarchy. At the operational level, which is the lowest, majority of the problems are not open-ended and almost all the problem parameters are under the control of the decision maker [3]. As we move higher in the organisational levels the problems become more open-ended, their parameters become increasingly difficult to quantify precisely and certainly, and a number of parameters go beyond the control of the decision maker. The decision models of such problems at these levels are, by and large, informal and the modelling knowledge is often uncertain. In due course researchers and developers in the area of DSS began identifying characteristics which are common to DSS. One of the important characteristics is that the DSS are aimed at solving semi-structured decision problems and in doing so they use data and analysis models. These systems are interactive and meant for helping, not replacing, the decision makers. Further, they improve the effectiveness in decision making rather than the efficiency and operate under the control of the decision maker. For quite some time there was not a

single accepted definition of DSS because of the breadth of application areas and kind of decision making support involved.

REVIEW OF LITERATURE:

Making decisions concerning complex systems (e.g., the management of organizational operations, industrial processes, or investment portfolios; the command and control of military units; or the control of nuclear power plants) often strains our cognitive capabilities. Even though individual interactions among a system's variables may be well understood, predicting how the system will react to an external manipulation such as a policy decision is often difficult. What will be, for example, the effect of introducing the third shift on a factory floor? One might expect that this will increase the plant's output by roughly 50 percent. Factors such as additional wages, machine wear down, maintenance breaks, raw material usage, supply logistics, and future demand need also be considered; however, as they all will impact the total financial outcome of this decision. Many variables are involved in complex and often subtle interdependencies and predicting the total outcome may be daunting. There is a substantial amount of empirical evidence that human intuitive judgment and decision making can be far from optimal, and it deteriorates even further with complexity and stress [4]. Because in many situations the quality of decisions is important, aiding the deficiencies of human judgment and decision making has been a major focus of science throughout history. Disciplines such as statistics, economics, and operations research developed various methods for making rational choices. More recently, these methods, often enhanced by a variety of techniques originating from information science, cognitive psychology, and artificial intelligence, have been implemented in the form of computer programs, either as stand-alone tools or as integrated computing environments for complex decision making. Such environments are often given the common name of decision support systems (DSSs) [5].

1. Human Judgment and Decision Making:

Theoretical studies on rational decision making, notably that in the context of probability theory and decision theory, have been accompanied by empirical research on whether human behavior complies with the theory. It has been rather convincingly demonstrated in numerous empirical studies that human judgment and decision making is based on intuitive strategies as opposed to theoretically sound reasoning rules. These intuitive strategies, referred to as judgmental heuristics in the context of decision making, help us in reducing the cognitive load, but alas at the expense of optimal decision making. Effectively, our unaided judgment and choice exhibit systematic violations of probability axioms (referred to as biases). Formal discussion of the most important research results along with experimental data can be found in an anthology edited [10]. One might hope that people who have achieved expertise in a domain will not be subject to judgmental biases and will approach optimality in decision making [6]. While empirical evidence shows that experts indeed are more accurate than novices within their area of expertise, it also shows that they also are liable to the same judgmental biases as novices and demonstrate apparent errors and inconsistencies in their judgment.

2. Decision Support Systems:

Decision support systems are interactive, computer-based systems that aid users in judgment and choice activities. They provide data storage and retrieval but enhance the traditional information access and retrieval functions with support for model building and model-based reasoning. They support framing, modeling, and problem solving. Typical application areas of DSSs are management and planning in business, health care, the military, and any area in which management will encounter complex decision situations. Decision support systems are typically used for strategic and tactical decisions faced by upper-level management decisions with a reasonably low frequency and high potential consequences in which the time taken for thinking through and modeling the problem pays off generously in the long run. There are three fundamental components of DSSs [7].

- **Database management system (DBMS):** A DBMS serves as a data bank for the DSS. It stores large quantities of data that are relevant to the class of problems for which the DSS has been designed and provides logical data structures (as opposed to the physical data structures) with which the users interact. A DBMS separates the users from the physical aspects of the database structure and processing. It should also be capable of informing the user of the types of data that are available and how to gain access to them [8].

- **Model-base management system (MBMS):** The role of MBMS is analogous to that of a DBMS. Its primary function is providing independence between specific models that are used in a DSS from the applications that use them. The purpose of an MBMS is to transform data from the DBMS into information that is useful in decision making. Since many problems that the user of a DSS will cope with may be unstructured, the MBMS should also be capable of assisting the user in model building [9].

- **Dialog generation and management system (DGMS):** The main product of an interaction with a DSS is insight. As their users are often managers who are not computer-trained, DSSs need to be equipped with intuitive and easy-to-use interfaces. These interfaces aid in model building, but also in interaction with the

model, such as gaining insight and recommendations from it. The primary responsibility of a DGMS is to enhance the ability of the system user to utilize and benefit from the DSS. In the remainder of this article, we will use the broader term user interface rather than DGMS.

CONCLUSION:

Decision support systems are powerful tools integrating scientific methods for supporting complex decisions with techniques developed in information science, and are gaining an increased popularity in many domains. They are especially valuable in situations in which the amount of available information is prohibitive for the intuition of an unaided human decision maker and in which precision and optimality are of importance. Decision support systems aid human cognitive deficiencies by integrating various sources of information, providing intelligent access to relevant knowledge, aiding the process of structuring, and optimizing decisions. Normative DSSs offer a theoretically correct and appealing way of handling uncertainty and preferences in decision problems. They are based on carefully studied empirical principles underlying the discipline of decision analysis and they have been successfully applied in many practical systems. We believe that they offer several attractive features that are likely to prevail in the long run as far as the technical developments are concerned. Because DSSs do not replace humans but rather augment their limited capacity to deal with complex problems, their user interfaces are critical. The user interface determines whether a DSS will be used at all and if so, whether the ultimate quality of decisions will be higher than that of an unaided decision maker.

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