Historical Overview of Decision Support Systems (DSS)

Udo Richard Averweg
eThekwini Municipality and University of KwaZulu-Natal, South Africa

INTRODUCTION

During the late 1970s the term "decision support systems" was first coined by P. G. W. Keen, a British Academic then working in the United States of America. In 1978, Keen and Scott Morton published a book entitled, *Decision Support Systems: An Organizational Perspective* (Keen & Scott Morton, 1978), wherein they defined the subject title as computer systems having an impact on decisions where computer and analytical aids can be of value but where the manager's judgment is essential. Information systems (IS) researchers and technologists have developed and investigated decision support systems (DSS) for more than 35 years (Power, 2003b).

The structure of this article is as follows: The background to DSS will be given. Some DSS definitions, a discussion of DSS evolution, development of the DSS field and frameworks are then presented. Some future trends for DSS are then suggested.

BACKGROUND

Van Schaik (1988) refers to the early 1970s as the era of the DSS concept because during this period the concept of DSS was introduced. DSS was a new philosophy of how computers could be used to support managerial decision-making. This philosophy embodied unique and exciting ideas for the design and implementation of such systems. There has been confusion and controversy in respect of the interpretation of the decision support system notion and the origin of this notion originated in the following terms:

- **Decision** emphasises the primary focus on decision-making in a problem situation rather than the subordinate activities of simple information retrieval, processing or reporting.
- **Support** clarifies the computer's role in aiding rather than replacing the decision maker.
- **System** highlights the integrated nature of the overall approach, suggesting the wider context of machine, user and decision environment.

DSS deal with semi-structured and some unstructured problems.

DECISION SUPPORT SYSTEMS

With the ever-increasing advances in computer technology, new ways and means of computer-assisted decision-making was born. As a result hereof, over the passage of time, different DSS definitions arose:

- Little (1970) defines DSS as a "model-based set of procedures for processing data and judgments to assist a manager in his decision making (*sic*)."
- The classical definition of DSS, by Keen and Scott Morton (1978), states that "Decision Support Systems couple the intellectual resources of individuals with the capabilities of the computer to improve the quality of decisions. It is a computer-based support system for management decision makers who deal with semi-structured problems."
- Mann and Watson (1984) state that "a decision support system is an interactive system that provides the user with easy access to decision models and data in order to support semi-structured and unstructured decision-making tasks."
- Bidgoli (1989) defines DSS as "a computer-based information system consisting of hardware/software and the human element designed to assist any decision-maker at any level. However, the emphasis is on semi-structured and unstructured tasks."
- Sprague and Watson (1996) define a DSS as computer-based systems that help decision makers confront ill-structured problems through direct interaction with data and analysis models.
- Sauter (1997) notes that DSS are computer-based systems that bring together information from a variety of sources, assist in the organisation and analysis of information and facilitate the evaluation of assumptions underlying the use of specific models.
- Turban, Rainer, and Potter (2005) broadly define a DSS as "a computer-based information system that combines models and data in an attempt to solve semi-structured and some unstructured problems with extensive user involvement."

From these definitions it seems that the basis for defining DSS has been developed from the perceptions of what a DSS

does (e.g., support decision-making in semi-structured or unstructured problems) and from ideas about how a DSS's objectives can be accomplished (e.g., the components required and the necessary development processes).

Bidgoli (1989) contends that as the DSS field is in a state of flux, an exact definition of DSS is elusive. Turban (1995) indicates that previous researchers have collectively ignored the central issue in DSS; that is, "support and improvement of decision-making". Bidgoli (1989) suggests that there are several requirements for a DSS which must embrace a definition of a DSS. These are that a DSS:

- requires hardware;
- requires software;
- requires human elements (designers and end-users);
- is designed to support decision-making;
- should help decision makers at all levels; and
- emphasises semi-structured and unstructured tasks.

Turban (1995) states that there is no consensus on what a DSS is and there is therefore no agreement on the characteristics and capabilities of DSS. As the definition by Turban et al. (2005) underscores Bidgoli's (1989) DSS requirements, for the purposes of this article, the DSS definition by Turban et al. (2005) will be used.

Evolution of DSS

During the 1970s and 1980s, the concept of DSS grew and evolved into a field of research, development and practice (Sprague & Watson, 1996). Clearly DSS was both an evolution and a departure from previous types of computer support for decision-making.

Currently DSS can be viewed as a third generation of computer-based applications. Sprague and Watson (1996) note that initially there were different conceptualisations about DSS. Some organisations and scholars began to develop and research DSS which became characterised as *interactive* computer based systems which *help* decision makers utilise *data* and *models* to solve *unstructured* problems. According to Sprague & Watson (1974), the unique contribution of DSS resulted from these key words. However, a serious definitional problem arose in that the words had certain "intuitive validity"—any system that supports a decision (in any way) is a "decision support system". This term had such an instant intuitive appeal that it quickly became a "buzz word" (Sprague & Watson, 1996). However, neither the restrictive nor the broad DSS definition provided guidance for understanding the value, the technical requirements or the approach for developing and implementing a DSS. For a discussion of DSS implementation, see, for example, Averweg (1998).

Development of the DSS Field

According to Sprague and Watson (1996), DSS evolved as a "field" of study and practice during the 1980s. During the early development of DSS, several principles evolved. Eventually, these principles became a widely accepted "structural theory" or framework—see Sprague and Carlson (1982). The four most important of these principles are summarised:

- **The DDM Paradigm:** The technology for DSS must consist of three sets of capabilities in the areas of **d**ialog, **d**ata and **m**odelling and what Sprague and Carlson call the DDM paradigm. The researchers make the point that a good DSS should have *balance* among the three capabilities. It should be *easy to use* to allow non-technical decision makers to interact fully with the system. It should have access to a *wide variety of data* and it should provide *analysis and modelling* in a variety of ways. Sprague and Watson (1996) suggest that many early systems adopted the name DSS when they were strong in only one area and weak in the other. Figure 1 shows the relationship between these components in more detail and it should be noted that the models in the model base are linked with the data in the database. Models can draw coefficients, parameters and variables from the database and enter results of the model's computation in the database. These results can then be used by other models later in the decision-making process.
  Figure 1 also shows the three components of the dialog function wherein the database management system (DBMS) and the model base management system (MBMS) contain the necessary functions to manage the data base and model base respectively. The dialog generation and management system (DGMS) manages the interface between the user and the rest of the system.
- **Levels of Technology:** Three levels of technology are useful in developing DSS and this concept illustrates the usefulness of configuring *DSS tools* into a *DSS generator* which can be used to develop a variety of *specific DSS* quickly and easily to aid decision makers—see Figure 2. The system which actually accomplishes the work is known as the *specific DSS*, shown as the circles at the top of the diagram. It is the software/hardware that allow a specific decision maker to deal with a set of related problems. The second level of technology is known as the *DSS generator*. This is a package of related hardware and software which provides a set of capabilities to quickly and easily build a specific DSS. The third level of technology is *DSS tools* which facilitate the development of either a DSS generator or a specific DSS.