Decision Support Systems Concept

Daniel J. Power
University of Northern Iowa and DSSResources.com, USA

INTRODUCTION

Since the late 1960s, researchers have been developing and implementing computerized systems to support management decision makers. A number of decision support systems (DSS) typologies were proposed in the early 1980s (cf., Alter, 1980; Sprague & Carlson, 1982), but technology developments and new applications led to an expanded DSS framework (cf., Power, 2000a, 2000b, 2001). The expanded DSS framework developed in detail in Power (2002a) helps decision makers and DSS developers explain and categorize potential decision support projects as well as existing DSS.

Many terms are used for specific types of DSS. For example, some vendors and managers use the terms "business intelligence," "collaborative systems," "computationally oriented DSS," "data warehousing," "model-based DSS," and "online analytical processing (OLAP)" software to label decision support software. Software vendors use these more specialized terms for both descriptive and marketing purposes. The terms used to describe decision support capabilities are important in making sense about what technologies have been deployed or are needed. Some DSS are subsystems of other information systems, and this common structural design adds to the complexity of categorizing and identifying DSS. In general, DSS are a broad class of information systems used to assist people in decision-making activities (cf., Power, 2004).

According to Alter (1980), DSS can "take on many different forms and can be used in many different ways" (p. 71). DSS differ in terms of capabilities and targeted users of a specific system, and in terms of how the DSS is implemented and what it is called. Some DSS focus on data, some on models, and some on facilitating communications and collaboration. DSS also differ in scope. Some DSS are intended for one "primary" user and "stand alone" for analysis, and other DSS are intended for many users in an organization.

BACKGROUND

Traditionally, academics and practitioners have discussed building DSS in terms of four major components: the user interface, the database, the models and analytical tools, and the DSS architecture and network (cf., Sprague & Carlson, 1982). This traditional list of components identifies similarities and differences between categories or types of DSS. The expanded DSS framework is primarily based on the differential emphasis placed on the DSS components when systems are actually constructed. The importance of the components in providing decision support functionality is the major differentiating factor among various types of DSS.

The expanded DSS framework focuses on one major dimension, with five categories and three secondary dimensions. The major characteristic in the framework is the dominant technology component that drives or provides the decision support functionality. Five generic categories based on the dominant component are discussed in this section: communications-driven, data-driven, document-driven, knowledge-driven, and model-driven DSS. The following categories (with explanations based on Power, 2001, 2002a, 2004) can classify DSS currently in use:

- Communications-driven DSS include systems built using communication, collaboration, and decision support technologies. These systems were developed first in the late 1980s and are called groupware. Group DSS also involve communications, but many GDSS derive their functionality by providing a group of users with access to quantitative decision models.
- Data-driven DSS include file drawer and management reporting systems, data warehousing and analysis systems, executive information systems (EIS), and some spatial DSS (SDSS). Business intelligence systems are also examples of data-driven DSS. Data-driven DSS emphasize access to and manipulation of large databases of structured data and, especially, a time-series of internal company data and sometimes external data. Simple file systems accessed by query and retrieval tools provide the most elementary level of functionality. Data warehouse systems that allow the manipulation of data by computerized tools tailored to a specific task and setting or by more general tools and operators provide additional functionality. Data-driven DSS with OLAP, drill-down, and scorecards provide the highest level of functionality and decision support

that are linked to the analysis of a large collection of historical data.

- Document-driven DSS integrate a variety of storage and processing technologies to provide complete document retrieval, summarization, and analysis. A search tool that creates text summaries and rates document relevance provides decision support functionality, but the dominant component is the document base. Examples of documents that might be included in a document database include policies and procedures, product specifications, catalogs, and corporate historical information, including minutes of meetings, corporate records, and important correspondence.
- Knowledge-driven DSS can suggest or recommend actions to managers. These DSS contain specialized problem-solving expertise based upon artificial intelligence and statistics technologies. The "expertise" consists of knowledge about a particular domain, understanding of problems within that domain, and "skill" at solving some of these problems.
- Model-driven DSS include systems that use accounting and financial models, representational simulation models, and optimization models. Model-driven DSS emphasize access to and manipulation of a model. A simple algebraic model with "what if?" analysis provides the most elementary level of model-driven DSS functionality.

Table 1 summarizes the five types of DSS and the expanded DSS framework. Data-driven, document-driven, and knowledge-driven DSS need different and specialized database components to provide decision support. A data-driven DSS needs a relational or a multidimensional database of structured data. A document-driven DSS need a specialized document repository and, in some instances, a relational database to assist in document searching. A knowledge-driven DSS needs to store knowledge, including rules, frames, or likelihood data. A model-driven DSS derives functionality from the model component. Finally, the communications and networking component is the key driver for a communications-driven DSS.

FUTURE TRENDS

The number of DSS of each generic type is expanding rapidly. In general, each generic type of DSS can be targeted to the same user group. Also, a given decision process may benefit from implementation of multiple DSS. Each DSS can have a narrow, specific purpose or a more general purpose. DSS of any type can serve multiple, overlapping purposes. For example, to provide business intelligence to managers, more than one DSS may be needed, including both a data-driven DSS and a document-driven DSS. Finally, each category of DSS can be deployed using a Web-based architecture. Today, Web technologies (Linux, Apache server, MySQL, PHP) provide a powerful DSS development environment. DSS can, should, and will be categorized in terms of these three secondary dimensions—user groups, purpose, and the enabling technology.

One can and should use all four dimensions in Table 1 to categorize a specific DSS. Some specific questions for identifying the type of DSS include the following:

Table 1. Summary of D. Power's expanded DSS framework

Dominant Component	User Group	Purpose	Enabling Technology
Communications **Communications-Driven DSS**	Intra- and interorganization users	Conduct a meeting, post on a Bulletin Board	Web-based or LAN
Database **Data-Driven DSS**	Managers, staff, intra- and interorganization	Query a data warehouse, ad hoc analysis	Mainframe, LAN, Web-based
Document-base **Document-Driven DSS**	Specialists, managers	Search Web pages, find documents	Web-based
Knowledge-base **Knowledge-Driven DSS**	Internal users, customers	Management advice, choose products	LAN or Web-based
Models **Model-Driven DSS**	Managers and staff, customers	Crew scheduling, decision analysis	Stand-alone PC, Web-based

Source: Based on Power (2002a)