# Decision-Making Support Systems

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## INTRODUCTION

Decision-making support systems (DMSS) are computer-based information systems designed to support some or all phases of the decision-making process (Forgionne, Mora, Cervantes, & Kohli, 2000). There are decision support systems (DSS), executive information systems (EIS), and expert systems/knowledge-based systems (ES/KBS). Individual EIS, DSS, and ES/KBS, or pair-integrated combinations of these systems, have yielded substantial benefits in practice.

DMSS evolution has presented unique challenges and opportunities for information system professionals. To gain further insights about the DMSS field, the original version of this article presented expert views regarding achievements, challenges, and opportunities, and examined the implications for research and practice (Forgionne, Mora, Gupta, & Gelman, 2005). This article updates the original version by offering recent research findings on the emerging area of intelligent decision-making support systems (IDMSS). The title has been changed to reflect the new content.

## BACKGROUND

Decision-making support systems utilize creative, behavioral, and analytic foundations that draw on various disciplines (Sage, 1981). These foundations give rise to various architectures that deliver support to individual and group DMSS users. The architectures, which are summarized in Table 1, include (a) classic systems (Alter, 1996) such as decision support systems (DSS), expert and knowledge-based systems (ES/KBS), executive information systems (EIS), group support systems (GSS), and spatial decision support systems (SDSS) and (b) new systems (Forgionne, 1991; Forgionne, Mora, Cervantes, & Gelman, 2002a; Gray & Watson, 1996; Mora, Forgionne, Gupta, Cervantes, & Gelman, 2003; Power, 2002; Turban & Aronson, 1998) such as management support systems (MSS), decision technology systems (DTS), integrated DMSS, data warehouse (DW)-based and data mining (DM)-based DMSS (DW&DM-DMSS), intelligent DMSS (i-DMSS), and Web-based DMSS or knowledge-management DMSS.

The architectures have been applied to various public and private problems and opportunities, including the planning of large-scale housing demand (Forgionne, 1997), strategic planning (Savolainen & Shuhua, 1995), urban transportation policy formulation (Rinaldi & Bain, 2002), health care management (Friedman & Pliskin, 2002), pharmaceutical decision making (Gibson, 2002), banking management (Hope & Wild, 2002), entertainment industry management (Watson & Volovino, 2002), and military situations (Findler, 2002). Applications draw on advanced information technologies (IT), such as intelligent agents (Chi & Turban, 1995), knowledge-based (Grove, 2000) and knowledge-management procedures (Alavi, 1997), synthetic characters (Pistolesi, 2002), and spatial decision support systems (Silva, Eglese, & Pidd, 2002), among others.

## DMSS ACHIEVEMENTS

Once created, DMSS must be evaluated and managed. Economic-theory-based methodologies, quantitative and qualitative process and outcome measures, and the dashboard approach have been used to measure DMSS effectiveness. These approaches suggest various organizational structures and practices for managing the design, development, and implementation effort. Most suggestions involve much more user involvement and a larger role for nontraditional specialists during the technical design, development, and implementation tasks.

To gain further insights about DMSS achievements, challenges, and opportunities posed by the development, the

*Table 1. Decision-making support systems architectures*

| Classic DMSS Architectures | Description | Main Decision-Making Phase Supported | | | | | DMSS' SUPPORT CHARACTERISTICS |
|---|---|---|---|---|---|---|---|
| | | INTELLIGENCE | DESIGN | CHOICE | IMPLEMENTATION | LEARNING | |
| DSS | A DSS is an interactive computer-based system composed of a user-dialog system, a model processor and a data management system, which helps decision makers utilize data and quantitative models to solve semi-structured problems. | | | **A** | | | (A) What-if, goal seeking, & sensitivity analysis. |
| ES & KBS | An ES/KBS is a computer-based system composed of a user-dialog system, an inference engine, one or several intelligent modules, a knowledge base, and a work memory, which emulates the problem-solving capabilities of a human expert in a specific domain of knowledge. | **A** | | **B** | | | (A&B) Symbolic pattern-based recognition; fuzzy data; how and why explanation facilities. |
| EIS | An EIS is a computer based system composed of a user-dialog system, a graph system, a multidimensional database query system and an external communication system, which enables decision makers to access a common core of data covering key internal and external business variables by a variety of dimensions (such as time and business unit). | **A** | | | **B** | | (A&B) Key performance indicators (KPI's) in graphs and text tables; data exploring and searching through drill-down, roll-up, slice and dice and pivoting operations; networking communications to internal and external bulletin boards. |
| GSS | A GSS an integrated computer based system composed of a communication sub-system and model-driven DMSS (DSS), to support problem formulation and potential solution of unstructured decision problems in a group meeting. | | **A** | **B** | | | (A) Idea generation through brainstorming facilities; pooling and display of ideas; generation of alternatives and criteria.<br>(B) Preference models; voting schemes; conflict negotiation support. |
| SDSS | A SDSS a computer based system composed of a user-dialog sub-system, a geographic/ spatial database sub-system, a decision model sub-systems and a set of analytical tools, which enables decision makers to treat with situations based strongly on spatial data. | **A** | | **B** | | | (A) Spatial data searching support; visualization tools for maps, satellite images, and digital terrains.<br>(B) What-if analysis of scenarios, goal-seeking analysis, sensitivity analysis of decision variables upon spatial data. |

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