Decision support systems

Decision support systems are a subset of business intelligence aimed at helping organizations make informed business decisions based on vast troves of analyzed data.

Decision support systems definition

A decision support system (DSS) is an interactive information system that analyzes large volumes of data for informing business decisions. A DSS supports the management, operations, and planning levels of an organization in making better decisions by assessing the significance of uncertainties and the tradeoffs involved in making one decision over another.

A DSS leverages a combination of raw data, documents, personal knowledge, and/or business models to help users make decisions. The data sources used by a DSS could include relational data sources, cubes, data warehouses, electronic health records (EHRs), revenue projections, sales projections, and more.

History of DSS:

The concept of decision support systems grew out of research conducted at the Carnegie Institute of Technology in the 1950s and 1960s, but really took root in the enterprise in the 1980s in the form of executive information systems (EIS), group decision support systems (GDSS), and organizational decision support systems (ODSS).

These says, as organizations become increasingly focused on data-driven decision making, decision science (or decision intelligence) is on the rise, and decision scientists may be the key to unlocking the potential of decision science systems. Bringing together applied data science, social science, and managerial science, design science focuses on selecting between options to reduce the effort required to make higher-quality decisions.

Decision support systems vs. business intelligence:

Decision support systems and business intelligence (BI) are often conflated. Some experts consider BI a successor to DSS. Decision support systems are generally recognized as one element of business intelligence systems, along with data warehousing and data mining.

Whereas BI is a broad category of applications, services, and technologies for gathering, storing, analyzing, and accessing data for decision-making, DSS applications tend to be more purpose-built for supporting specific decisions. For example, a business DSS might help a company project its revenue over a set period by analyzing past product sales data and current variables. Healthcare providers use clinical decision support systems to make the clinical workflow more efficient: computerized alerts and reminders to care providers, clinical guidelines, condition-specific order sets, and so on.

Categories of decision support systems

In the book Decision Support Systems: Concepts and Resources for Managers, Daniel J. Power, professor of management information systems at the University of Northern Iowa, breaks down decision support systems into five categories based on their primary sources of information.

Data-driven DSS. These systems include file drawer and management reporting systems, executive information systems, and geographic information systems (GIS). They emphasize access to and manipulation of large databases of structured data, often a time-series of internal company data and sometimes external data.

Model-driven DSS. These DSS include systems that use accounting and financial models, representational models, and optimization models. They emphasize access to and manipulation of a model. They generally leverage simple statistical and analytical tools, but Power notes that some OLAP systems that allow complex analysis of data may be classified as hybrid DSS systems. Model-driven DSS use data and parameters provided by decision-makers, but Power notes they are usually not data-intensive.

Knowledge-driven DSS. These systems suggest or recommend actions to managers. Sometimes called advisory systems, consultation systems, or suggestion systems, they provide specialized problem-solving expertise based on a particular domain. They are typically used for tasks including classification, configuration, diagnosis, interpretation, planning, and prediction that would otherwise depend on a human expert. These systems are often paired with data mining to sift through databases to produce data content relationships.

Document-driven DSS. These systems integrate storage and processing technologies for document retrieval and analysis. A search engine is an example.

Communication-driven and group DSS. Communication-driven DSS focuses on communication, collaboration, and coordination to help people working on a shared task, while group DSS (GDSS) focuses on supporting groups of decision makers to analyze problem situations and perform group decision-making tasks.

Uses of Decision support system examples:

Decision support systems are used in a broad array of industries. Example uses include:

- **GPS route planning.** A DSS can be used to plan the fastest and best routes between two points by analyzing the available options. These systems often include the capability to monitor traffic in real-time to route around congestion.
- **Crop-planning.** Farmers use DSS to help them determine the best time to plant, fertilize, and reap their crops. Bayer Crop Science has applied analytics and decision-support to every element of its business, including the creation of "virtual factories" to perform "what-if" analyses at its corn manufacturing sites.
- **Clinical DSS.** These systems help clinicians diagnose their patients. Penn Medicine has created a clinical DSS that helps it get ICU patients off ventilators faster.
- **ERP dashboards.** These systems help managers monitor performance indicators. Digital marketing and services firm Clear link uses a DSS system to help its managers pinpoint which agents need extra help.

Components of a decision support system:

Decision support systems consist of three key components: the database, software system, and user interface.

1. **DSS database.** The database draws on a variety of sources, including data internal to the organization, data generated by applications, and external data purchased from third parties or mined from the Internet. The size of the DSS database will vary based on need, from a small, standalone system to a large data warehouse.

2. **DSS software system.** The software system is built on a model (including decision context and user criteria). The number and types of models depend on the purpose of the DSS. Commonly used models include:
   - **Statistical models.** These models are used to establish relationships between events and factors related to that event. For example, they could be used to analyze sales in relation to location or weather.
   - **Sensitivity analysis models.** These models are used for "what-if" analysis.
   - **Optimization analysis models.** These models are used to find the optimum value for a target variable in relation to other variables.
   - **Forecasting models.** These include regression models, time series analysis, and other models used to analyze business conditions and make plans.
   - **Backward analysis sensitivity models.** Sometimes called goal-seeking analysis, these models set a target value for a particular variable and then determine the values other variables need to hit to meet that target value.
3. **DSS user interface.** Dashboards and other user interfaces that allow users to interact with and view results.