Data Warehousing for Business Intelligence
Course 4: Business Intelligence Concepts, Tools, and Applications

Module 1 Bonus Materials

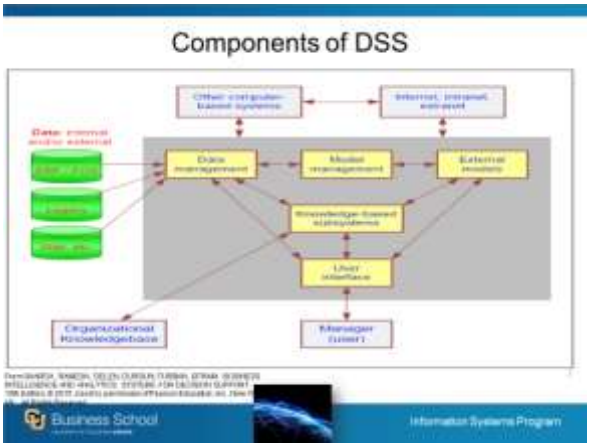
Lesson 3: Decision Support Systems

We've arranged for students in this MOOC to purchase at a very low cost digital versions of chapters 1, 2, and 4 of the authoritative textbook *Business Intelligence and Analytics: Systems for Decision Support*, 10th edition, 2015 by Sharda, R., Delen, D., and Turban, E. See the optional text book link under course overview to purchase (US$4 for one chapter, US$10 for all three; the regular price for students is $15 per digital chapter).

We are discussing systems that support people who make decisions, not systems that make decisions on their own. People who make business decisions are often high enough in the organization to have choices as to how they make their decisions, so it is important to support decision-making methods and styles that they are willing to use. Understanding the phases of decision making is important in developing automated support, as the kind of support needed depends on the decision phase.

As shown below, a DSS application can be composed of a data management subsystem, a model management subsystem, a user interface subsystem, and a knowledge-based management subsystem. The database management system is required to store and retrieve the variety of data required by a DSS. The model-management system is required to provide the capabilities to analyze the data. The user interface provides a mechanism for the user to be able to interact with the DSS. All these capabilities are necessary; none can be dispensed with. The knowledge-based management system, by contrast, provides knowledge or expertise that might also be provided by an experienced user or, possibly trading off decision quality for system cost and complexity, dispensed with entirely.

- The DSS software consists of data, model, and communication subsystems: (1`) Data subsystem embodies the database that is managed by database management system (DBMS) , (2) Model Subsystem also known as the problem-processing subsystem, consists of the model base management system (MBMS) (3) Communication (dialogue) subsystem is the system through which the user can communicate and command the DSS.
- The user is also referred to as the decision maker (1) is the person responsible for making the decision the DSS is designed to support (2) he or she may not actually run the system
- The hardware platforms for a DSS include time-sharing networks, the company mainframes, minicomputers, or combinations of these.



- The data management subsystem includes a database that contains relevant data for the situation and is managed by software called the database management system (DBMS). The data management subsystem can be interconnected with the corporate data warehouse, a repository for corporate relevant decision-making data. Usually, the data are stored or accessed via a database Web server. The data management subsystem is composed of the following elements: (1) DSS database, (2) Database management system, (3) Data directory, (4) Query facility.

- The model management subsystem is the component that includes financial, statistical, management science, or other quantitative models that provide the system's analytical capabilities and appropriate software management. Modeling languages for building custom models are also included. This software is often called a model base management system (MBMS). This component can be connected to corporate or external storage of models. Model solution methods and management systems are implemented in Web development systems (such as Java) to run on application servers. The model management subsystem of a DSS is composed of the following elements: (1) Model base, (2) MBMS, (3) Modeling language , (4) Model directory , (5) Model execution, integration, and command processor

- Interface includes (1) Application interface, (2) User Interface (GUI?). DSS User Interface includes (1) Portal, (2) Graphical icons, (3) Dashboard, (4) Color coding, (4) Interfacing with PDAs, cell phones, etc. The Web browser provides a familiar, consistent graphical user interface (GUI) structure for most DSS. For locally used DSS, a spreadsheet also provides a familiar user interface. A difficult user interface is one of the major reasons managers do not use computers and quantitative analyses as much as they could, given the availability of these technologies. The Web browser has been recognized as an effective DSS GUI because it is flexible, user friendly, and a gateway to almost all sources of necessary information and data. Essentially, Web browsers have led to the development of portals and dashboards, which front end many DSS. Explosive growth in portable devices including smartphones and tablets has changed the DSS user interfaces as well. Some DSS user interfaces utilize natural-language input (i.e., text in a human language) so that the users can easily express themselves in a meaningful way.

DSS Classification

Dan Power is the founder of DSS Resources (www.DSSResouces.com), a comprehensive website devoted to decision support. On his website, Power provides a contemporary classification system for DSS. His DSS taxonomy includes the following five categories:

- *Data-driven DSS*. Many DSS developed in OLAP and reporting analytics software systems fall into this category. There is minimal emphasis on the use of mathematical models. These applications involve the manipulation of large amounts of numerical data that is often resident in a data warehouse. Examples include reports, dashboards/scorecards, and online analytical processing and Business performance management, which are the focus of this course. Cognos is a tool that provides OLAP cube functionality, which is another characteristic of data driven DSS systems.
- *Document-driven DSS.* A *document-driven DSS* relies on knowledge coding, analysis, search, and retrieval for decision support. This includes all text-based DSS and most KMS. Document-driven DSS have minimal emphasis on mathematical models. Useful information for decision support is often in documents, such as Word files, scanned documents, images, sounds, and video. Systems that support the search and retrieval of documents are document-based DSS. The main objective of document-driven DSS is to provide support for decision making using documents in various forms: oral, written, and multimedia. Document-driven DSS rely on knowledge coding, analysis, search, and retrieval for decision support. They essentially include all DSS that are text based. Most KMS fall into this category. These DSS also have minimal emphasis on utilizing mathematical models.
- *Knowledge-driven DSS.* These applications incorporate the knowledge, experience, and judgment of experts in a particular domain, and recommend courses of action. An expert system is an example of a knowledge-driven DSS. Essentially, all artificial intelligence–based DSS fall into this category. When symbolic storage is utilized in a DSS, it is generally in this category. ANN and ES are included here. Because the benefits of these *intelligent DSS* or *knowledge based DSS* can be large, organizations have invested in them. These DSS are utilized in the creation of *automated decision-making systems*
- *Model-driven DSS.* The focus of such systems is on using the model(s) to optimize one or more objectives (e.g., profit). The most common end-user tool for DSS development is Microsoft Excel. Excel includes dozens of statistical packages, a linear programming package (Solver), and many financial and management science models.
- These applications focus on the use of sophisticated algorithms, such as optimization and simulation models. Examples include revenue management and production planning.
- *Communications-driven DSS*. These are applications that support collaboration and communication. Examples include group decision support systems and audio and video conferencing. Essentially, all DSS that support any kind of group work fall into this category. They include those that support meetings, design collaboration, and even supply chain management. Knowledge management systems (KMS) that are developed around communities that practice collaborative work also fall into this category.
- Power's classification system is appealing because it retains the field's long-standing DSS term, yet is broad enough to cover emerging applications. Often DSS is a hybrid of many classes.

Evolution of DSS applications

According to the source above, A DSS could include (1) A knowledge management system (KMS), (2) Marketing, finance, and accounting systems (ERP Systems), (3) Supply chain management system (SCM), (4) Rule based Expert Systems (ES). An organization may have (for example) a knowledge management system to guide all its personnel in their problem solving, it may have separate support systems for marketing, finance, and accounting, a supply chain management (SCM) system for production, and several expert systems for product repair diagnostics and help desks. The term *DSS* encompasses them all.

- Executive Information Systems: These systems are used to access news, stock prices, and information about competitors, customers, key performance indicators, and internal operations using

dashboards and scorecards (similar to dashboards in cars). Executive Work has the following characteristics (1) Activities are usually diverse, brief, and fragmented (2) Verbal communications are preferred, in part, because of the opportunity for the exchange of soft information-- gossip, ideas, opinions, predictions, and explanations (3) It is more unstructured, non-routine, and long-range in nature than other managerial work, (4) Centers around developing agendas (goals, priorities, strategies) and plans that may not be documented, (5) Network building and cooperative relationships (with people inside and outside the organization who may play a role in developing and implementing the emerging agenda). Executives need (1) External information: trade journals, friends in industry, and customers, (2) Internal Information: scheduled meetings, unscheduled meetings, and tours are highly valued sources of internal information

- GSS provides support for (1) idea generation and evaluation, (2) use of sophisticated decision aid tools, (3) creating and managing the agenda, (4) group writing and record keeping. A GDSS mainly supports the process of decision making rather than the solution of a specific problem. For example, conferencing systems support group decision making remotely (GOTO-MEETING). People do not have to travel to participate in meetings. The conferencing systems support all the decision making activities of the participants anytime, anywhere.
- ES are computer programs that incorporate the knowledge of one or more human experts in a narrow problem domain and can solve problems that the expert(s) ordinarily solve. The 911 system is great example of ES system. When you make a 911 call, the operator access an ES system to diagnose the problem and dispatch police or paramedics. Major reasons a company may want to use and ES include: (1) Ability to capture critical expertise, (2) Faster application development, (3) Ability to distribute knowledge, (4) Desire to gain competitive advantage, (5) Flexibility to free experts from making repetitive decisions, (6) Ability to combine knowledge from several experts.
- Geographic information systems (GIS) can be utilized either as stand-alone systems (Suri) or integrated with these systems so that a decision maker can determine opportunities and problems in a spatial sense (911 system). These days people are very much dependent on GIS systems to locate services on daily basis on their mobile devices. So are the business for making location and marketing decisions by knowing exactly the demographics in each location. These relationships can be exploited for competitive advantage (e.g., CRM identifies classes of customers to approach with specific products and services).
- A KMS can be used to identify similar past situations and how they were handled. Many use Wikipedia on daily basis to search knowledge on specific topics. Companies use internal Wikis to post policies and procedures associate with employment, memos and internal documents
- GSS can be used to share information and for brainstorming. Cell phone and GPS data can be captured to create a micro-view of customers and their habits.

EIS and DSS are also both aimed at individual users in contrast to systems that are aimed at facilitating group-based interactions in decision making such as GDS systems. Another underlying thread of commonality among these is that they draw upon and provide structure to or analysis of a database or repository of data for a variety of decision-making needs.

As a whole these systems are called Management Support Systems (MSS). MSS encompass information systems that are used to support management actions at institutional level. These systems provide significant data, information, or knowledge access that can be specific to individual or group needs while providing the ability to "roll up" these elements to support broader organizational decision making needs. Used in this way, *MSS* describes any computerized system that supports decision making in an organization. An organization may have (for example) a knowledge management system to guide all its personnel in their problem solving, it may have separate support systems for marketing, finance, and accounting, a supply chain management (SCM) system for production, and several expert systems for product repair diagnostics and help desks. The term *DSS* encompasses them all.

If these systems all support decision making then the question arises: what is it that unites them? What is the thread of continuity, or what elements do these have in common, that organizations have pursued over the past several decades to make their decision making support systems successful?

See the course links to vendors and software companies and additional web resources for this lesson for further information.