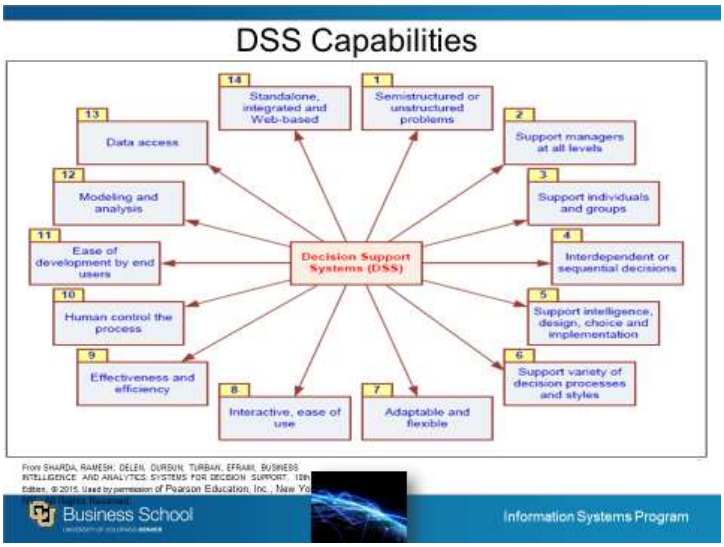
Data Warehousing for Business Intelligence
Course 4: Business Intelligence Concepts, Tools, and Applications

Module 1 Bonus Materials

Lesson 4: DSS in practice

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).

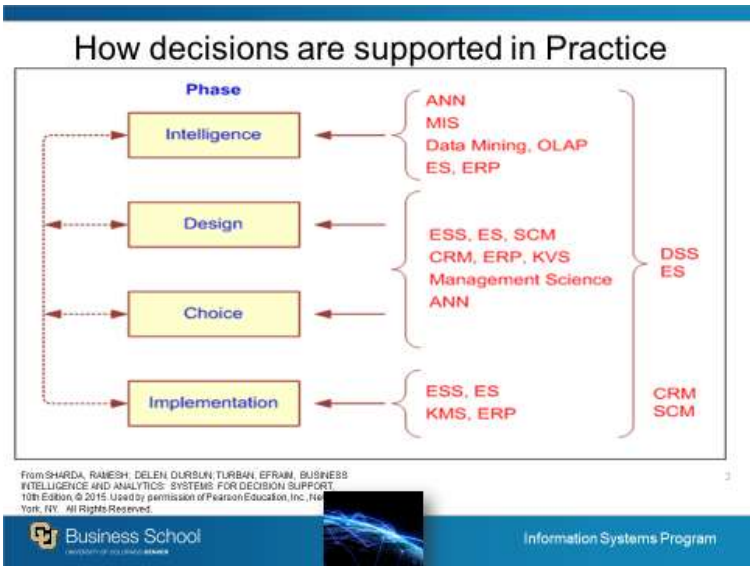


1. Support for decision makers, mainly in semistructured and unstructured situations, by bringing together human judgment and computerized information. Such problems cannot be solved (or cannot be solved conveniently) by other computerized systems or through use of standard quantitative methods or tools. Generally, these problems gain structure as the DSS is developed. Even some structured problems have been solved by DSS.
2. Support for all managerial levels, ranging from top executives to line managers.
3. Support for individuals as well as groups. Less-structured problems often require the involvement of individuals from different departments and organizational levels or even from different organizations. DSS support virtual teams through collaborative Web tools. DSS have been developed to support individual and group work, as well as to support individual decision making and groups of decision makers working somewhat independently.
4. Support for interdependent and/or sequential decisions. The decisions may be made once, several times, or repeatedly.
5. Support in all phases of the decision-making process: intelligence, design, choice, and implementation.
6. Support for a variety of decision-making processes and styles.
7. The decision maker should be reactive, able to confront changing conditions quickly, and able to adapt the DSS to meet these changes. DSS are flexible, so users can add, delete, combine, change, or

rearrange basic elements. They are also flexible in that they can be readily modified to solve other, similar problems.

8. User-friendliness, strong graphical capabilities, and a natural language interactive human–machine interface can greatly increase the effectiveness of DSS. Most new DSS applications use Web-based interfaces or mobile platform interfaces.
9. Improvement of the effectiveness of decision making (e.g., accuracy, timeliness, quality) rather than its efficiency (e.g., the cost of making decisions). When DSS are deployed, decision making often takes longer, but the decisions are better.
10. The decision maker has complete control over all steps of the decision-making process in solving a problem. A DSS specifically aims to support, not to replace, the decision maker.
11. End users are able to develop and modify simple systems by themselves. Larger systems can be built with assistance from information system (IS) specialists. Spreadsheet packages have been utilized in developing simpler systems. OLAP and data mining software, in conjunction with data warehouses, enable users to build fairly large, complex DSS.
12. Models are generally utilized to analyze decision-making situations. The modeling capability enables experimentation with different strategies under different configurations.
13. Access is provided to a variety of data sources, formats, and types, including GIS, multimedia, and object-oriented data.
14. The DSS can be employed as a stand-alone tool used by an individual decision maker in one location or distributed throughout an organization and in several organizations along the supply chain. It can be integrated with other DSS and/or applications, and it can be distributed internally and externally, using networking and Web technologies.

These key DSS characteristics and capabilities allow decision makers to make better, more consistent decisions in a timely manner, and they are provided by the major DSS components



- *Intelligence phase:* The primary requirement of decision support for the intelligence phase is the ability to scan external and internal information sources for opportunities and problems and to interpret what the scanning discovers. Web tools and sources are extremely useful for environmental scanning.

Another aspect of identifying internal problems and opportunities is monitoring operations. Business activity monitoring, business process management, and product life-cycle management provide such capability. Routine and ad-hoc reports can also help: regular reports can be designed to assist in problem finding by comparing expectations with current and projected performance. The support is provided in terms of (1) Enabling continuous scanning of external and internal information sources to identify problems and/or opportunities, (2) Resources/technologies: (3) Web; ES, OLAP, data warehousing, data/text/Web mining, EIS/Dashboards, KMS, GSS, GIS,…(4) Business activity monitoring (BAM), (5) Business process management (BPM), (6) Product life-cycle management (PLM)

- *Design phase:* This phase involves generating alternative courses of action, agreeing on choice criteria and their weights, and forecasting the consequences of various alternatives. Several of these activities can use standard models such as financial and forecasting models. Either standard or special models can generate alternatives for structured problems. OLAP and data mining software are useful in identifying relationships to use in such models. An expert system can assist with qualitative methods as well as with the expertise required in selecting quantitative analysis and forecasting models.
- *Choice phase:* In addition to providing models that rapidly identify a best or good-enough alternative, a DSS can support the choice phase through what-if and goal-seeking analyses. Different scenarios can be tested for the selected option to reinforce the final decision. A knowledge management system helps identify similar past experiences; CRM, ERP, and SCM systems can test the impact of each choice. If a group makes the decision, a group support system can provide support to lead to consensus. The support is provided in terms of (1) Enabling selection of the best alternative given a complex constraint structure, (2) Use sensitivity analyses, what-if analyses, goal seeking, (3)Resources: KMS, CRM, ERP, and SCM, Simulation and other descriptive models
- *Implementation phase:* DSS can be used in implementation activities such as decision communication, explanation, and justification. Implementation phase DSS benefits are partly due to the vividness and detail of analyses and reports used for these purposes.

All phases of the decision-making process can be supported by improved communication by collaborative computing through GSS and KMS. Computerized systems can facilitate communication by helping people explain and justify their suggestions and opinions. Decision implementation can also be supported by expert systems. An ES can be used as an advisory system regarding implementation problems (such as handling resistance to change). Finally, an ES can provide training that may smooth the course of implementation.

- Impacts along the value chain are typically identified by BAM, BPM, SCM, and ERP systems. CRM systems report and update internal records based on the impacts of the implementation. These inputs are then used to identify new problems and opportunities— a return to the intelligence phase. The support are in terms of (1) Enabling implementation/deployment of the selected solution to the system, (2) Decision communication, explanation and justification to reduce resistance to change, and (3) Resources: Corporate portals, Web 2.0/Wikis, Brainstorming/GSS, KMS, ES.
- The Internet and advanced database technologies have created a glut of data and information available to decision makers— so much that it can detract from the quality and speed of decision making. Web tools and sources are extremely useful for environmental scanning. Web browsers provide useful front ends for a variety of tools, from OLAP to data mining and data warehouses. Data sources can be internal or external. Internal sources may be accessible via a corporate intranet. External sources are many and varied.

Decision support/BI technologies can be very helpful. For example, a data warehouse can support the intelligence phase by continuously monitoring both internal and external information, looking for early signs of problems and opportunities through a Web-based enterprise information portal (also called a dashboard). Similarly, (automatic) data (and Web) mining (which may include expert systems [ES], CRM, genetic algorithms, neural networks, and other analytics systems) and (manual) OLAP also support the intelligence phase by identifying relationships among activities and other factors. Geographic information systems (GIS) can be

utilized either as stand-alone systems or integrated with these systems so that a decision maker can determine opportunities and problems in a spatial sense. 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. GSS can be used to share information and for brainstorming. Even cell phone and GPS data can be captured to create a micro-view of customers and their habits.

> Another aspect of identifying internal problems and capabilities involves monitoring the current status of operations. When something goes wrong, it can be identified quickly and the problem can be solved. Tools such as business activity monitoring (BAM), business process management (BPM), and product life-cycle management (PLM) provide such capability to decision makers. Both routine and ad hoc reports can aid in the intelligence phase. For example, regular reports can be designed to assist in the problem-finding activity by comparing expectations with current and projected performance. Web-based OLAP tools are excellent at this task. So are visualization tools and electronic document management systems.

The design phase involves generating alternative courses of action, discussing the criteria for choices and their relative importance, and forecasting the future consequences of using various alternatives. Several of these activities can use standard models provided by a DSS (e.g., financial and forecasting models, available as applets). Alternatives for structured problems can be generated through the use of either standard or special models. However, the generation of alternatives for complex problems requires expertise that can be provided only by a human, brainstorming software, or an ES. OLAP and data mining software are quite useful in identifying relationships that can be used in models. Most DSS have quantitative analysis capabilities, and an internal ES can assist with qualitative methods as well as with the expertise required in selecting quantitative analysis and forecasting models. A KMS should certainly be consulted to determine whether such a problem has been encountered before or whether there are experts on hand who can provide quick understanding and answers. CRM systems, revenue management systems, ERP, and SCM systems software are useful in that they provide models of business processes that can test assumptions and scenarios.

- A knowledge management system, if available, can be consulted to determine whether such a problem has been encountered before, or if there are experts on hand to provide quick understanding and answers. CRM systems, revenue management systems, ERP, and SCM software are useful in providing models of business processes that can test assumptions and scenarios. If a problem requires brainstorming to help identify important issues and options, a group DSS may prove helpful. … In addition to providing models that rapidly identify a best or good-enough alternative, a DSS can support the choice phase through what-if and goal-seeking analyses. Different scenarios can be tested for the selected option to reinforce the final decision. Again, a KMS helps identify similar past experiences; CRM, ERP, and SCM systems are used to test the impacts of decisions in establishing their value, leading to an intelligent choice. An ES can be used to assess the desirability of certain solutions as well as to recommend an appropriate solution. If a group makes a decision, a GSS can provide support to lead to consensus.

The DSS benefits provided during implementation may be as important as or even more important than those in the earlier phases. DSS can be used in implementation activities such as decision communication, explanation, and justification. Implementation-phase DSS benefits are partly due to the vividness and detail of analyses and reports.

> Decision implementation can also be supported by ES. An ES can be used as an advisory system regarding implementation problems (such as handling resistance to change). Finally, an ES can provide training that may smooth the course of implementation. Impacts along the value chain, though reported by an EIS through a Web-based enterprise information portal, are typically identified by BAM,

BPM, SCM, and ERP systems. CRM systems report and update internal records, based on the impacts of the implementation. These inputs are then used to identify new problems and opportunities—a return to the intelligence phase.

Generations of DSS

- The first generation is associated with the early DSS applications where a need for a separate data repository was recognized and the data was organized around specific DSS applications. This is an application-centric approach to decision-support data management.
- The second generation is traditional data warehousing where the warehouse is an enterprise-wide resource that supports a wide variety of applications. This approach is data-centric.
- The third generation is real time data warehousing and warrants being called a new generation because it changes the paradigm for BI. It, too, is data-centric.

- DSS are becoming more embedded in other systems. Similarly, a major area to expect improvements in DSS is in GSS in supporting collaboration at the enterprise level. This is true even in the educational arena. Almost every new area of information systems involves some level of decision-making support. Thus, DSS, either directly or indirectly, has impacts on CRM, SCM, ERP, KM, PLM, BAM, BPM, and other EIS. As these systems evolve, the active decision-making component that utilizes mathematical, statistical, or even descriptive models increases in size and capability, although it may be buried deep within the system. We expect to see more seamless integration of DSS components as they adopt Web technologies, especially XML. These Web-based technologies have become the center of activity in developing DSS. Web-based DSS have reduced technological barriers and have made it easier and less costly to make decision-relevant information and model-driven DSS available to managers and staff users in geographically distributed locations, especially through mobile devices.

- Finally, different types of DSS components are being integrated more frequently. For example, GIS are readily integrated with other, more traditional, DSS components and tools for improved decision making. By definition, a DSS must include the three major components—DBMS, MBMS, and user interface. The knowledge-based management subsystem is optional, but it can provide many benefits by providing intelligence in and to the three major components. As in any other MIS, the user may be considered a component of DSS. Over time, the decision support scene changed. Additional applications appeared, such as executive information systems (EIS), group decision support systems (GDSS), and geographic information systems (GIS), with their own unique characteristics and names.

Data warehouses stored massive amounts of decision support data and were key to reporting, online analytical processing (OLAP), and dashboard/scorecard applications. Rapid strides were made with data visualization…. In addition to numerical data, other data entered the decision support world, such as documents and web pages. And the Internet became the delivery platform for BI/DSS. Today, enterprise users, however, need a technology to access integrated data, to store, to analyze and to make better decisions. ….

- As you will see there is key difference between DSS and BI applications. In a very strict sense, business intelligence (BI) systems monitor situations and identify problems and/ or opportunities, using analytic methods. Reporting plays a major role in BI; the user generally must identify whether a particular situation warrants attention, and then analytical methods can be applied. Again, although models and data access (generally through a data warehouse) are included in BI, DSS typically have their own

databases and are developed to solve a specific problem or set of problems. They are therefore called DSS applications.

See the Ready Made DSS Products and Services and use some of the DSS for supporting various decisions.