

Chapter 2

Gaining Competitive Advantage with Decision Support Systems

INTRODUCTION

During the past 50 years, managers and MIS professionals have created many important transaction-oriented Strategic Information Systems (Callon, 1996; Neumann, 1994). These systems have significantly improved the processing of business transactions and created business advantages. In some organizations, the search for strategic opportunities remains focused on enhancing business transaction processing. This focus on business operations is too narrow. Although transaction processing can involve managerial decision-making, redesigning transaction processing systems (TPS) creates advantages that are very different from the advantages that can result from building a novel DSS. A Decision Support System meets different needs and serves different purposes than TPS. Managers need to recognize that innovative strategic decision support applications can provide substantial opportunities for targeting sales efforts, improving strategic control and improving profits. Information technology advances are creating new DSS capabilities that can and should be used to build innovative, specific DSS that yield competitive advantage for an organization.

Today, many companies have fragmented and isolated decision support capabilities that are hard to use and hard to access. For example, a data mart may have been built for analyzing customer data, a project management system may exist for tracking large-scale projects, or Excel analyses may be routinely used in a business decision process. Also, managers are experiencing information overload and are having difficulty finding the right information when it is needed.

You may be asking: Can a new or upgraded DSS really provide a competitive advantage to a company? A DSS can be a strategic information

system, and a specific DSS can create a competitive advantage. Managers need to know when and why DSS are competitive weapons.

Evidence indicates managers can now use sophisticated data-driven and document-driven DSS to obtain information that was buried for many years in filing cabinets or archived on computer tapes. Model-driven DSS can reduce waste in production operations and improve inventory management. Knowledge-driven DSS can analyze cash register transaction data and help managers find relationships in consumer buying behavior that increase sales and inventory turnover. Communications-driven DSS can support teams working all over the world. Interorganizational DSS can support a company's suppliers and customers. Also, by reducing stock-outs and inventory carrying costs an interorganizational DSS can increase the number of happy customers. A Decision Web Portal can provide access to information from different systems, synchronize relevant and personalized information, support collaboration, and extend decision support to partners, customers and suppliers.

This chapter provides examples of how various types of DSS can enhance and improve managerial decision-making processes and, in some cases, provide an organization with a competitive advantage. It emphasizes understanding technology trends, gaining a competitive advantage, discussing how DSS can provide a competitive advantage, examples of Strategic DSS, characteristics of Strategic DSS, identifying opportunities and Information Systems Planning, and finally, DSS risks and benefits.

TECHNOLOGY TRENDS

Computers have become indispensable tools in companies, government offices, and in most other organizations. For many managers, computers are recognized and accepted as necessary productivity tools. Despite the general and widespread acceptance of computers and their important role in organizations, the business computing revolution is far from complete. If anything, the pace of technology change is speeding up, not slowing down, and the expectations for computers and information systems in companies continues to expand and grow (cf., Power and Kaparthy, 1998). So, what are the trends associated with information technology that may have a major impact on the design and development of DSS? In my opinion:

1. Network technologies are very important and mission-critical in most companies. Computing and network technologies have become more integrated and more powerful. The speed and capacity of networks is increasing. Bandwidth expansion can support interactive video and real-time decision support any where in the world. Access to fast network connections is becoming widespread and less costly. An open architectural view of networking and computing is dominating IS/IT thinking and the development of DSS. Decision support applications are and will be needed 7 days a week and 24 hours a day in many companies; if the network is down, decisions won't be made.
2. Open source software may impact some DSS development tools. With access to source code programmers can read, redistribute, and modify the software;

- advocates of open source software feel the software will evolve faster (cf., www.opensource.org). For example, Linux is becoming an important operating system for Web servers in corporations. Major vendors like IBM and Oracle are supporting some open source software like Linux and the Apache Web server. This trend is negatively impacting the use of proprietary UNIX and Microsoft Windows software as the corporate server environments of choice.
3. Visualization technologies are more powerful than at any time in the past. New software helps users visualize almost anything they can imagine in a realistic, manipulatable format. Visualization tools can help pilots simulate flights and help managers “try” new products.
 4. The World Wide Web is expanding and it is forcing major changes in business transaction processing. But the Web is much more than a means of transferring order entry tasks to customers. The Web supports e-business including internal and external global communications, decision making, and collaboration for managers. Also, the Web can help managers gather, manage, share, and use information.
 5. The World Wide Web is facilitating new models of business cooperation, including extranets, interorganizational DSS and shared computing resources. For example, interorganizational and supply-chain decision support applications can be outsourced and hosted by application service providers.
 6. Handheld computing is gaining greater acceptance, and the use of pocket PCs by managers and other employees will increase. Wireless Web devices are expected to outnumber wired devices in the next few years. Pocket PCs support distributed data collection for data-driven DSS, expanded communications-driven DSS and distributed decision making. Mobile computing systems extend the reach of an enterprise-wide DSS.
 7. Large data storage systems and multiprocessing computers have removed the constraints on what can be stored and how much data can be stored. Data storage is faster and it is easier to organize and backup data of all types. Web site logs, customer documents and data from transactions can be kept forever in a form that can be sorted, analyzed and processed.

This list of trends is incomplete and dated even as it is written. Seizing opportunities to build innovative DSS involves continuously monitoring technology trends and having the courage to “think outside of the box.” This prescription is already trite, but the need to innovate remains if a company is to gain a competitive advantage from building a DSS.

GAINING COMPETITIVE ADVANTAGE

A DSS creates a competitive advantage if three criteria are met. First, once the DSS is implemented, it must be used, and it must become a major or significant strength or capability of the organization. Second, the DSS must be unique and proprietary to the organization. Third, the advantage provided by the DSS must be sustainable for at least three years. Even with rapid technology change, a three-year payback is a realistic target. Managers who are searching for strategic investments in information technology need to keep these three criteria in mind. In general, a competitive advantage means an organization does something important much better than its competitors.

The widespread use of computer technology has changed the way companies do business. Information technology has altered relationships between companies and their suppliers, customers, and rivals. Porter and Millar (1985) discuss two specific ways that information technology can affect competition: by altering industry structures, and by supporting cost and/or differentiation strategies. A common approach used to identify opportunities to change the structure and profitability of an industry is to examine five competitive forces and the business value chain. Michael Porter (1979) argued that the power of buyers, the power of suppliers, the threat of new entrants, the threat of substitute products, and the rivalry among existing competitors determines the profitability of an industry. How a company uses information technology can affect each of the five competitive forces and can create the need and opportunity for change. For example, information technology has altered the bargaining relationships between companies and their suppliers, channels, and buyers. Information systems can cross company boundaries and support supply chains. These inter-organizational systems have become common, and, in some instances, they have changed the boundaries of the participating industries. DSS can reduce the power of buyers and suppliers. DSS can erect new barriers that reduce the threat of entrants, help differentiate products and services, and reduce the threat from substitutes. Also, DSS can help managers reduce the cost of rivalry actions and, in some cases, lessen the need for competitive actions and reactions.

Some firms have no competitive advantage. Firms can achieve a competitive advantage by making strategic changes, and firms can lose a competitive advantage when competitors make strategic changes. Information systems and information technologies are changing rapidly and are viewed by many managers as “strategic weapons” for gaining competitive advantage. These systems are also known as Strategic Information Systems (SIS).

SIS are systems designed to change goals, products, services, or environmental relationships of organizations. Some authors argue that any information system that helps an organization compete is an SIS (cf., Neumann, 1994). Both definitions should guide managers in their search for ways to use information technology to support decision making. DSS that create changes in products, services, or relationships are especially important for gaining an advantage over competitors.

Strategic Impact Grid

Information systems and information technology play different roles in different industry settings. McFarlan, McKenney, and Pyburn (1983) proposed a four-quadrant strategic impact model of the strategic relevance of information systems and information technologies (IS/IT) (see Table 2.1). Firms in the *Factory* quadrant are dependent on cost-effective, reliable IS/IT operational support for internal operations. Firms with mainframe legacy systems, including some direct mail processing companies and some banks, fall in this category. IS/IT development emphasizes maintenance and program improvements. Smooth functioning of computerized systems is vital to daily operations. New

decision support applications in data warehousing, On-Line Analytical Processing (OLAP) and GDSS are potentially useful, but are not a priority and are not fundamental to the ability of a firm in this quadrant to compete.

	Low impact of new IS/IT applications	High impact of new IS/IT applications
High strategic impact of existing IS/IT	Factory	Strategic
Low strategic impact of existing IS/IT	Support	Turnaround

Table 2.1 Categories of Strategic Relevance

In the *Strategic* quadrant, information systems and information technologies are essential for executing current strategies and operations for firms. For example, e-businesses like Amazon.com and Ameritrade, Inc. are dependent on Internet and database technologies to operate. Information systems are critical to the survival and competitive position of the firm. In this quadrant, novel decision support applications will be crucial to future competitive success.

In the *Support* quadrant, information technology resources are important for applications like accounting and payroll, but firms are not dependent on technology. Examples of industries with firms in this category include job shop manufacturing, restaurants, and funeral services. Firms in this quadrant that develop innovative DSS are unlikely to gain competitive advantage.

In the *Turnaround* quadrant, managers who want to use information systems and especially DSS to improve the competitive position of a firm will encounter special challenges. Firms in this quadrant are usually trying to revitalize operations through new Transaction Processing Systems (TPS). These firms have not previously depended on IS/IT, and yet new applications will likely impact their survival. Firms in this quadrant are laggards and can come from many industries. Some indicators that a firm is in this quadrant include the enabling technologies in use, the applications that are being implemented, and the attitudes of the IS/IT staff. If most of the attention is on implementing “new” TPS, then the firm is probably in the turnaround quadrant.

The strategic impact grid can help managers analyze a firm’s current information systems position. Firms in the *Strategic* quadrant are in the best position to gain advantage from building novel DSS. Multibusiness corporations can also use the grid to compare several business units or divisions.

HOW CAN DSS PROVIDE A COMPETITIVE ADVANTAGE?

Evans and Wurster (1997) argued in a recent *Harvard Business Review* article that the world is in the midst of a fundamental shift in the economics of information. They argue that major changes will occur in the structure of entire industries and in the ways companies compete. The change that they believe is so important is the widespread adoption of Internet technologies, which they see as supporting new behaviors that are reaching critical mass. They claim millions of people are communicating at home and at work in an explosion of connectivity that threatens to undermine the established value chains for businesses in many sectors of the economy.

Internet technologies have also opened wide the doors for innovative Web-based DSS. Interorganizational DSS can improve linkages with customers and suppliers. In some situations, communications-driven DSS can remove time and location barriers. DSS can help a firm operate 7 days a week, 24 hours a day and without regard to an employee's or a customer's location. In some cases, DSS can help integrate a firm's operations. An interorganizational, Web-based DSS can create linkages to customers and suppliers that are difficult to challenge or overcome.

DSS can potentially help a firm create a cost advantage by providing many benefits, including improving personal efficiency and reducing staff needs, expediting problem solving, and increasing organizational control. Managers who want to create a cost advantage should search for situations where decision processes seem slow or tedious and where problems reoccur or solutions are delayed or unsatisfactory. In some cases, DSS can reduce costs where decision makers have high turnover and training is slow and cumbersome, and in situations where activities, departments, and projects are poorly controlled.

Also, DSS can create a major cost advantage by increasing efficiency or eliminating value-chain activities. For example, a bank or mortgage loan firm may reduce costs by using a new DSS to consolidate the number of steps and minimize the number of staff hours needed to approve loans. Technology breakthroughs can sometimes continue to lower process costs, and rivals who imitate an innovative DSS may nullify or remove any advantage.

Potentially, DSS can create a differentiation advantage. Providing a DSS to customers can differentiate a product and possibly provide a new service. Differentiation increases profitability when the price premium charged is greater than any added costs associated with achieving the differentiation. Successful differentiation means a firm can charge a premium price, and/or sell more units, and/or increase buyer loyalty for service or repeat purchases. In some situations, competitors can rapidly imitate the differentiation, and then all competitors incur increased costs for implementing the DSS.

Finally, DSS can be used to help a company better focus on a specific customer segment and hence gain an advantage in meeting that segment's needs. MIS and DSS can help track customers, and DSS can make it easier to serve a specialized customer group with special services. Some customers won't pay a premium for targeted service, or larger competitors may also target specialized niches using their own DSS.

WHAT COMPANIES HAVE GAINED AN ADVANTAGE WITH DSS?

A major problem in answering this question is that firms want to maintain any advantage they gain, and hence, they are, and should be, reluctant to release many details about a decision support system that provides them a competitive advantage. Also, DSS that provide an advantage at one point in time may seem dated or ordinary after only a few years. An advantage from information technology can be fleeting and short-term (cf., Feeny and Ives, 1990).

In a retrospective research study, Kettinger, Grover, Guha and Segars (1994) identified 30 companies that had gained an advantage from Information Systems. Some of the systems were DSS, but most were TPS. Based on their study, the following companies developed DSS that provided a significant sustainable advantage: Air Products & Chemicals, Inc. developed a vehicle scheduling system; Cigna Corp. implemented a risk assessment system; Digital Equipment Corp. built an expert configurator; IBM created a marketing management system; and Owens-Corning built a materials selection system.

Many of the above DSS have probably been enhanced or redeveloped since they were initially implemented. Having the best technology at one point in time and “innovating first” do not guarantee continued success. Today many consulting firms and software vendors focus on gaining competitive advantage from a data warehouse or a business intelligence system, and that can happen. Many DSS projects do not, however, deliver such results, and cannot create a competitive advantage.

If a company is trying to develop a DSS that provides a competitive advantage, managers and DSS analysts should ask about the uniqueness of the project, IS/IT capabilities, and impacts on costs, customer and supplier relations, and managerial effectiveness. Based on examining specific examples of DSS, managers need to continually invest in a strategic DSS to maintain any advantage. Also, managers should keep the DSS proprietary and secret to maintain an advantage. The above examples and those in the next section demonstrate that some innovative decision support systems can provide a sustainable competitive advantage.

SOME EXAMPLES OF STRATEGIC DSS

The following examples at Frito-Lay, L.L. Bean, Lockheed-Georgia, Mrs. Field’s Cookies, and Wal-Mart should clarify how DSS can provide a competitive advantage. These examples are “classics” that have been widely reported in business case studies and the popular press.

Frito-Lay

In the late 1980s, Frito-Lay (www.fritolay.com/home.html) managers felt that they needed to redesign the sales process into a more decentralized organization where route sales people were given decision-making authority on promotions and product mix (cf., Applegate, 1994). The development of a handheld computer enabled this strategic transition to occur. Route sales people collected data on every sales transaction for every customer on a route. Ten

thousand Frito-Lay salespeople use handheld computers to track Frito-Lay products. These notebook size computers produce a vast quantity of data that flows into the data center at Frito-Lay headquarters in Texas. This data is used in a data-driven DSS. This technology automated a cumbersome process and improved the quality of data that was already being collected. The technology also provides data to support decentralized decision making while maintaining centralized control systems.

L.L. Bean

In the spring of 1989, L.L. Bean (www.llbean.com) hired consultants to design a system that would provide better allocation of resources in telemarketing. Managers decided to have an Economic Optimization Model (EOM) built in-house (cf., Quinn, Andrews, and Parsons, 1991).

The EOM system required a shift in focus for the company from a traditional service-level criterion, such as 14 calls per agent per hour, to a method that would optimize economic efficiencies. This model-driven DSS examined variables such as the number of telephone lines to carry incoming traffic, the number of agents, and the queue capacity or the number of wait positions for sales agents. Then, through various mathematical modeling tools, the system generated specific resource amounts L.L. Bean should deploy to be most economically advantageous. The system takes into account many variables. For example, installation and maintenance costs of telephone lines, labor costs of sales agents including their training, costs associated with being on hold with the 800-service provider, and the cost of permanently lost orders. This new profitability based model continues to add resources until the marginal cost of additional resources exceeds the return on that investment. EOM also scheduled the resources based on fluctuations in activity. When one group of operators became overwhelmed, the next shift of operators would be starting, and then as things were becoming slow, one group of operators would soon be leaving.

From a \$ 40,000 capital investment in the system, the company estimated a profit gain of \$ 9.2 million to \$ 10 million for 1989. Sales call volumes were up 6.5 percent over the previous year. Managers, who attributed the majority of the gains to the new EOM system, benefited from an integrated planner that could evaluate “what if” scenarios. Most importantly, L.L. Bean’s reputation with customers improved. Other benefits included decreased customer wait times, improved morale of employees, and reduced lost order penalties. The EOM provided L.L. Bean a competitive advantage.

Lockheed-Georgia

In 1975, Robert B. Ormsby, president of Lockheed-Georgia, a subsidiary of cargo aircraft producer Lockheed Corporation, was interested in the development of an on-line reporting system that could provide top executives with concise, timely, relevant information that could be shared within the organization to aid with decision making. In the fall of 1978, development began

for a Management Information and Decision Support (MIDS) system (cf., Houdeshel and Watson, 1987).

The intended benefits of MIDS were improved communications, an evolving understanding of information requirements by the organization, and cost reductions in the generation of reports and presentation materials. MIDS helped managers identify areas that require attention; thus enabling improved decision making. Information became more timely, since it was updated as events occurred, and accuracy was improved through the verification of all information before it was made available.

After 12 years of successful operation, in 1990, MIDS required a hardware update. At this time, managers reviewed both hardware and software and decided to purchase a commercial Executive Information System (EIS) called Commander EIS from Comshare (www.comshare.com) instead of developing another in-house system. MIDS II, as it became known, resembled the look and feel of the previous system. Lockheed requested that Comshare provide the ability to operate the system through a keyboard in addition to mouse and touch screen, and they wanted the ability of the old MIDS system to monitor use of the system. Lockheed also requested that these changes be done not only to their version, but also to all Commander EIS packages, thus enabling easier upgrades. MIDS II rolled out in 1992 with faster response times, easier navigation, better links to outside resources, and lower maintenance costs.

Mrs. Field's Cookies

Mrs. Field's Inc. (www.mrsfields.com) developed a management information system in the early 1980s to provide uniformity in store management while supporting the objective of rapid expansion. The information system was designed to serve two purposes for the company. The first was control and the other was better management decision making for store managers. What evolved from these needs was a strategic information system that was designed to enable each store to operate in a manner similar to the way Debbi Field ran the original Palo Alto store. Her husband, Randy Field, did this by creating a software system that put decision-making support and operating data on a store-level computer. The software gave the store manager time to do "those tasks that people uniquely do." The system was justified on the basis of potential payback, its ability to generate new sales, and the strategic importance in acquiring competitive advantage (cf., Applegate and Pearlson, 1994).

A DSS was developed that automated routine activities and responded to exceptions by prompting the store manager for input. Eventually, these exceptions were structured and the system responded automatically to many situations. On a more sophisticated level, the system tracked financial performance of each store, provided comprehensive scheduling of operations, including marketing support, tracked hourly sales goals, and even assisted with candidate interview selection. Each store's Tandy PC accessed the corporate management system. Many applications were menu-driven, such as day planning, time clocks, store accounting, inventory management, interviewing schedules, skill testing, and e-mail. After entering basic workday characteristics,

the system would run a mathematical model to compute the day's schedule of events, including how many cookies to bake of each type, when to mix and cook them, and projected sales per hour. Store sales were periodically entered into the system, and then revised projections and recommendations were requested. Using sales and inventory information, the system prepared and generated supply orders. Corporate headquarters was able to learn quickly when a store was not meeting expectations, and managers could respond.

Wal-Mart

In the early 1990s, Wal-Mart (www.walmart.com) implemented a number of Strategic DSS including Retail Link and a Sales data warehouse. Wal-Mart collects sales data from its stores in its data warehouse. Retail Link consolidated data into useful reports, and distributes it to suppliers with weekly forecasting information. In addition to forecasting information, suppliers get electronic order forms that help ensure there is an adequate supply of the items that Wal-Mart needs. This system used electronic data interchange (EDI) and satellite technologies to create a competitive advantage that other retailers like KMart have tried to imitate. The result of Retail Link has been reduced inventory in stores, more inventory of the right products at the right time and place, improved revenues for both supplier and retailer, and better partner relationships with suppliers. Retail Link is an example of an interorganizational DSS.

Wal-Mart also developed a large data warehouse to support decision making by Wal-Mart's merchandise buyers. In 1997, Wal-Mart increased the size and information analysis capabilities of its data warehouse. In a press release, Randy Mott, senior vice president and chief information officer for Wal-Mart, said " Our business strategy depends on detailed data at every level." Mott explained " Every cost, every line item is carefully analyzed, enabling better merchandising decisions to be made on a daily basis. It is the foundation for maintaining Wal-Mart's competitive edge and its continuing success in providing everyday low prices and superior customer satisfaction."

In 1998, Wal-Mart and Warner-Lambert began using the Internet to communicate interactively about sales forecasts. They reduced the time a product is in the supply chain by two and a half weeks. That translates into millions of dollars in reduced inventory. Today Wal-Mart is using Web technologies to support collaborative decision making in its supply chain.

IDENTIFYING OPPORTUNITIES AND INFORMATION SYSTEMS PLANNING

How can a manager identify opportunities to create DSS that can provide a competitive advantage? To determine if it is possible to gain advantage from DSS, a manager needs to use a creative search process to identify problems and needs. A cursory review of articles indicates there are many planning processes and analysis frameworks that might help (cf., Neumann, 1994). The Information Systems planning process should provide a systematic method of searching for and evaluating opportunities. IS planning must be linked to business strategic

planning, and the process should be ongoing and open-ended. Managers need to collect competitive intelligence, fund DSS research and development projects, conduct brainstorming sessions, and follow hunches and intuition. Managers need to look at business decision processes and their decision tasks from an outsider's perspective. Hiring a consultant who is perhaps a bit unorthodox or is willing to question assumptions may also help.

The Decision Support Readiness Audit in Appendix I can help assess a company's readiness for developing and using innovative and potentially strategic DSS. Both IS and line managers should complete the audit and any discrepancies should be examined. Completing an audit can be part of an IS planning process.

Information systems planning needs to examine the technical infrastructure to determine what is currently possible and examine enhancements that would facilitate or enable new capabilities. IS planning should involve broad consultation and both problem-oriented and opportunistic search. DSS do not always solve specific problems; rather DSS may create new capabilities. Evaluating DSS opportunities is sometimes difficult because of problems with assessing costs and benefits. In some situations the analysis will be directed to a "build versus buy" decision because industry-specific packages are available. This type of DSS may be needed, but it probably will not provide a competitive advantage.

DSS projects have various levels of risk associated with them. When DSS projects have ambiguous objectives and low structure, the projects have higher levels of risk because the costs and scope of work of the project are hard to define. Also, because the objectives of the project are ambiguous, it can be difficult to assess the return on the investment. DSS projects with a higher degree of structure and more clearly defined objectives generally are lower risk. More detailed planning is possible for projects with specific objectives. The project scope in terms of the number of users served and the size of databases developed also impacts the risk of the assessed projects. Small DSS projects, in terms of scope or dollar expenditures, tend to be of lower risk than large projects. Finally, the sophistication of the technology and the experience of the developers using the technology influences the overall project risk. The ultimate decision to invest in a DSS project should not be based solely on project risk. Sometimes, the DSS project that is most likely to result in a competitive advantage is the riskiest project (cf., Applegate et al., 1996).

If managers want to develop effective IS plans and evaluate DSS projects, it is important that they attend IS, industry, and vendor conferences. Also, to gain knowledge and search for opportunities, managers and MIS staff should use the World Wide Web to search for DSS information and visit DSS vendor Web sites. The DSSResources.COM Web site provides a knowledge resource about many aspects of DSS.

DSSResources.COM (Decision Support Systems Resources) is a Web-based knowledge repository. The mission of the site is to help people who are interested in learning how to use information technologies and software to improve business and organizational decision making. The target audience is MIS professionals, MIS students, managers interested in DSS, and academics

teaching MIS/DSS. The site is needed because decision support technology is changing and evolving very rapidly. MIS managers, business managers, and academics face a difficult challenge trying to stay abreast of those changes and to make good, informed decisions about building and maintaining DSS for organizations.

People are challenged by too much information and by too many sources of information. Much of the information about DSS is hard to find or “noisy.” The DSSResources.COM Web site is an integrated source of information relevant to DSS and it is a “living” hypertext document. The ongoing challenge is to have the site reflect the state of the art in DSS research and practice. DSS Resources changed its URL to DSSResources.COM on September 29, 1999.

DSS BENEFITS, LIMITATIONS, AND RISKS

Development and implementation of DSS has risks. Gaining any advantage may require a large financial investment. Competitors’ responses to the innovation may result in a heated race to gain or regain lost market share or provide the new capability. The competitive race can evolve into one of technology one-upmanship rather than one of better meeting customer needs. Sometimes the development of a strategic information system can shift power away from a specific company or an entire industry (cf., Porter and Millar, 1985). Technology risks include picking the wrong vendor, using a new technology too early in the technology life cycle, or using a technology that soon becomes obsolete. The inability to predict human behaviors and reactions, and the basic human instinct to resist change makes people the greatest risk when building new systems. No matter how wonderful a proposed DSS, if people resist the change, then the new system will fail. To gain an advantage a new DSS must work as planned and a company’s stakeholders must perceive its strategic significance for the firm.

All categories and types of DSS focus on improving the effectiveness of decision-makers rather than on increasing the efficiency of data storage and retrieval. Managers should routinely ask how a proposed computerized DSS would do this. In what ways do any type of computerized support system increase managerial effectiveness? The following are common individual and organizational benefits of DSS cited by Alter (1980), Turban (1995), Udo and Guimaraes (1994), and others:

1. *Improve individual productivity.* One of the ways to help people become more effective decision makers is to help them become more efficient in manipulating data. At a minimum, a new DSS should allow a person either to perform the same task in less time or perform the same task more thoroughly in the same length of time. The result of automating the clerical component of decision-related tasks is often to improve consistency and accuracy and to allow people to spend more of their time on the substantive rather than clerical aspects of their jobs.

2. *Improve decision quality and speed up problem solving.* A data-driven DSS can provide faster turnaround in retrieving decision-relevant information; can improve consistency and accuracy in decision making; and it may provide

better ways of viewing or solving problems. Users of data-driven DSS can often obtain answers to ad hoc or nonroutine questions quickly. Decision makers can consider more alternatives. Knowledge-driven DSS may reduce the variability in the application of guidelines and policies. Model-driven DSS can help managers conduct “what if” analyses and modify their assumptions and scenarios in financial planning. Communications-driven DSS can reduce the length of management feedback loops and the need to revise analyses. Problems seem to get resolved faster. Also, some managers perceive that DSS provides an “impartial” source of information that encourages “fact-based” decision making. This perception expedites problem solving.

3. *Improve interpersonal communications.* DSS provide users with “tools of persuasion” to help them support an action based on analysis or show that “a good job” has been done. Many types of DSS can provide managers in an organization with a vocabulary and a process for decision making and discussion.

4. *Improve decision making skills.* Frequently, learning occurs as a by-product of the initial and ongoing use of a DSS. Two types of learning seem to occur: learning of new concepts and the development of a better factual understanding of the business and decision-making environment. Some DSS serve as de facto training tools for new employees. Some knowledge-driven DSS reduce the expertise needed by an employee to perform satisfactorily and help newcomers gain expertise. Knowledge-driven DSS may also preserve expertise that might be lost through the resignation or retirement of an acknowledged expert.

5. *Increase organizational control.* Some data-driven DSS provide summary data for purposes of overall organizational control. Summary data can be monitored, retained, and analyzed. Managers need to be very careful about how decision-related information is collected and then used for organizational control purposes. If employees feel threatened or spied upon when they are using a DSS, negative behaviors may occur. Trying to gain increased control of employee decision behavior can be counterproductive.

Other benefits cited for DSS include: extending a decision maker’s ability to process information and analyze it; helping a decision maker deal with complex, large-scale problems that would otherwise involve time-consuming data analysis; shortening or decreasing the amount of time needed to make a decision; improving the reliability and enforcing the structure of a decision process; encouraging exploration and discovery by the decision maker in less structured or more novel decision situations related to the domain or scope of the DSS; helping decision makers restructure or reconceptualize a problem space or decision context; confirming assumptions or generating new “facts” to support one’s reasoning or decision; and, as mentioned previously, creating a competitive or strategic advantage for an organization.

DSS definitely can have positive benefits for some managers and organizations, but they can also create negative outcomes in situations. For example, some DSS development efforts can lead to power struggles over who should have access to data. Also, managers may have personal motives for advocating development of a DSS. A DSS can increase the “visibility” of its

sponsor and have positive rewards if it is successful. Some IS staff support DSS implementations so they can experiment with new technology or expand staff rather than because they believe in the proposed DSS. Isolating and identifying hidden agendas is difficult, but DSS proponents in IS and management must attempt to examine them. The successful development and use of DSS requires that people accept the DSS and are motivated to help make the project a success. Hidden agendas can hurt the motivation of all the people involved in a DSS development project.

DSS have limitations: A DSS is structured for a specific purpose and the data and models limit how it can be used; DSS have a “domain” of use; DSS often need to be integrated into decision processes; DSS can not support decision makers unless a decision maker chooses to use the system and incorporates the analyses into “off line” thinking and analysis; DSS have technology limitations. Finally, DSS are a form of behavioral engineering, and many managers resist such interventions.

Some DSS development opportunities are better than others. The key task for managers is understanding new technology and being able to develop only those systems that create positive business results, while rejecting those that use “technology for the sake of technology.” Using IS/IT to gain competitive advantage definitely has risks.

RESISTANCE TO USING DECISION SUPPORT SYSTEMS

Since DSS often have positive benefits, why do some managers resist using them? Let’s examine seven possible explanations for management resistance to using DSS that are cited in the literature. First, managers may have insufficient computer training. Because managers are receiving more computer training, and new managers are quite sophisticated in their use of computer software, the magnitude of this problem seems to be decreasing. Second, some managers argue that using a DSS will diminish their status and force them to do a secretary’s work. Using a DSS is not the job of a secretary or personal assistant. Today, companies cannot afford to pay an assistant to help a manager use a computer to do their job. This concern about status is counterproductive and raises business costs.

Third, using a DSS may not fit a manager’s problem-solving style, which is sometimes intuitive rather than analytical. While this may be true, managers should use both analysis and intuition in solving problems. Fourth, using a DSS does not fit with the manager’s work habits of verbal and nonverbal problem solving in face-to-face meetings. DSS should not and cannot replace all face-to-face meetings. Communications-driven DSS are an adjunct to traditional meetings, and other DSS can often be used in a face-to-face meeting. Fifth, DSS models, interfaces, and systems are usually poorly designed. Poor design is a problem, but not an inherent problem. Managers need to be involved in building DSS, and more resources need to be focused on DSS design and development. Sixth, some managers argue that building and using a DSS is expensive and time-consuming. Using a DSS does not need to be time-consuming or tedious

or difficult. DSS can actually save managers time and speed up decision processes.

Seventh, information overload is a major problem for people, managers already receive too much information, and many DSS increase the overload. Although this can be a problem, DSS can help managers organize and use information. DSS can actually reduce and manage the information load of a user.

Many of the seven reasons cited above for not using DSS are excuses and rationalizations rather than meaningful objections. To gain competitive advantage, project champions and DSS developers need to overcome the problems caused by managers who resist the use of DSS.

Finally, companies must determine whom they want a proposed DSS to support and what result they want from the new DSS. For example, an interorganizational DSS should offer customers value. Value can be improved service, new products, lower product or service costs, or customization. Often these benefits come from an increase in short-term costs to the DSS provider, but this is better than allowing a competitor to lead in technology innovation and jeopardize an organization's market share in the long term.

CONCLUSIONS AND COMMENTARY

Companies must continually improve information technologies if they are to gain and maintain competitive advantage. Companies that invest significant time and money to achieve an advantage want a system that has sustainability. When competitors can quickly respond with similar or better systems, the result is a higher cost of doing business for all companies involved. To create sustainability, an organization can preempt its competitors by being first to innovate. This creates surprise, competitive respect, and time advantages. Alternatively, sustainability may be achieved through competitor intimidation. Creating a system that is large, complex, or risky can intimidate potential duplicators. Sustainability can, however, only be maintained through continual development and enhancement of a strategic system.

Today, many senior managers are trying to transform their companies into e-businesses. An electronic business infrastructure includes web-based TPS and DSS. If managers are trying to develop web-based strategic DSS, they should ask how improved decision support might affect company costs, customer and supplier relations and managerial effectiveness. Managers should also attempt to assess how a strategic DSS may impact competitors. Also, managers should try to determine if the impact of a contemplated DSS will have any adverse effects. Gaining a competitive advantage is only one of the potential benefits of an innovative DSS. The search for advantage should not blind managers to other benefits that a proposed DSS may provide managers and a company. Some very useful DSS do not provide a significant competitive advantage.