Chapter 12

Evaluating Decision Support System Projects

INTRODUCTION

Information technologies support a more global society, and many companies now compete in markets all around the world. To compete effectively, companies must integrate transaction processing and decision support systems. New systems are needed to support managers working in this new market environment. Telecommunications, shared databases, groupware, and data-driven and model-driven DSS must be integrated and coordinated. Many barriers, including language, differing regulations, and technology issues, must be overcome to make global transaction processing and decision support integration a reality. Integration in a company will not likely occur as part of one large-scale project; rather, it will most likely occur incrementally through the implementation of many smaller projects.

Most observers agree that new technologies have created many opportunities to implement innovative Decision Support Systems. This is the good news. The bad news is that many projects will not meet expectations, and some will be spectacular failures. To increase the success rate, it is essential to carefully evaluate proposed DSS projects.

Many managers and MIS professionals are involved in evaluating proposed DSS projects. The technical managers who need to focus on evaluating DSS projects include the chief information officer, corporate Information Technology (IT) professionals, database administrators, and network administrators. The business managers who evaluate innovative DSS projects include senior managers, strategic planners, business development managers, competitive intelligence analysts, and market researchers.

During a project proposal evaluation, one must be skeptical and must ask probing questions. Also, it is important to understand and use evaluation tools and techniques. For a DSS project, it is very important to examine technological

risks. But, organizational culture and international issues may be equally important when evaluating some DSS projects.

Common evaluation questions include: What is the return on investment for the proposed DSS project? What is the payback period? What is the opportunity cost? What are the anticipated benefits? What can be done with the proposed system that cannot be done with the current information systems? Do competitors have a data warehouse or On-Line Analytical Processing (OLAP) or an Executive Information System (EIS)? Managers should ask these questions about a proposed or even an in-process DSS project, but it may be difficult to provide satisfactory answers. Almost everyone agrees that evaluating and justifying a DSS project can be difficult and challenging.

This chapter focuses on the process of evaluating proposed DSS projects, especially Web-based projects; evaluation tools; evaluation criteria; international DSS issues, ethics and privacy issues, and finally, conclusions about evaluating DSS projects.

DSS PROJECT EVALUATION PROCESS

Managers evaluate many types of projects, but those involving information technologies are often considered challenging. Evaluating DSS projects is especially difficult and yet it must be an ongoing process for large-scale DSS projects. Evaluation activities should be commensurate or proportionate to the scope, complexity, and cost of a proposed DSS project. Project scope refers to the number of potential users, the size of the project staff, the potential impacts on existing systems, and the amount of programming or development effort that will be required. Also, project sponsors and project managers must decide what amount and type of evaluation is appropriate and necessary in their company's IT management environment. A very bureaucratic or political environment may necessitate additional evaluation activities.

A discussion of the process of evaluating DSS projects generates many questions. For example, when should DSS projects be evaluated? Should in-house capabilities be examined? When does vendor evaluation occur? What is the role of the project team in DSS project evaluation? Who should do the evaluation? Is a feasibility analysis always needed? How many "go-no go" opportunities do managers have? Most managers can add to this list. The next few paragraphs offer some suggestions about commonly asked questions.

Figure 12.1 portrays the evaluation process as a multi-stage cycle of development and evaluation. The scale of the project and the development approach determines what activities will actually occur and in what sequence. Evaluation should be performed periodically from the initial idea stage to the final post-implementation project evaluation. A DSS project can be revised or even canceled at any stage. The resources that have been expended on a project are "sunk" costs. One should not continue a bad project solely because money and resources have already been expended on it. Managers need to know when to cut their losses and divert funds to more feasible projects. Managers also need to know when, despite setbacks or unanticipated costs, that it is desirable to continue an important project.

On-Going DSS Project Evaluation Process

Stages

- Initial idea stage
- Formal feasibility analysis
- Scheduled milestones
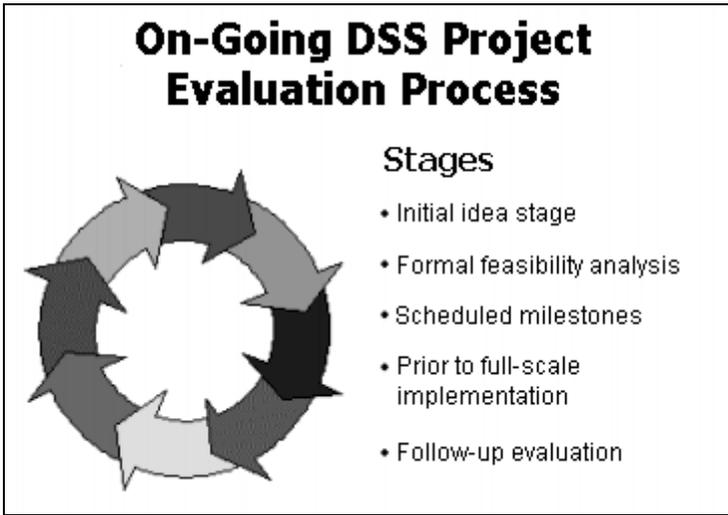- Prior to full-scale implementation
- Follow-up evaluation

Figure 12.1 – On-Going DSS Project Evaluation Process

First, there are several possible times and ways to evaluate a DSS project. At different times in the development of a DSS, a different type of evaluation may be needed. An initial DSS idea often needs nurturing. So at the initial idea stage, it is often appropriate to have a positive, developmental evaluation. At some point in the design stage for a DSS project, a feasibility study needs to be completed. Even small-scale end user-built DSS projects need to be evaluated. Often a feasibility study actually improves the understanding of a proposed DSS. The extent of the feasibility study should be a function of the size or scope and type of proposed DSS. A feasibility study for a Web-based, data-driven DSS should be much more extensive than a study for a small-scale model-driven DSS on a single personal computer.

Managers should conduct some type of evaluation of a large-scale DSS project at each step in the systems development life cycle or after each major change in a prototype. Prior to implementation, an enterprise-wide or interorganizational DSS must be carefully evaluated. Managers should not hesitate to delay implementation if problems are encountered. A DSS project will fail dramatically if problems are encountered doing the initial roll-out for the DSS. A DSS is usually best introduced in stages. The initial user group is critical to the overall long-term success of the project. After implementation, DSS should be regularly reviewed and evaluated. Technologies and user needs change, and a process should be in place to ensure that an obsolete DSS is not hurting decision making rather than enhancing it.

In-house capabilities should always be examined when evaluating DSS projects. In general, DSS projects should be implemented by in-house Information Systems (IS) staff. Innovative DSS projects enhance expertise of company IS/IT employees and involve staff in improving business decision

making. DSS applications should be treated as important business capabilities and not as candidates for outsourcing.

Since DSS are built using software development tools, vendor evaluation will be part of many innovative and large-scale DSS. When does vendor evaluation occur? Usually vendors are selected once a feasibility analysis is completed. Vendor capabilities and software should be considered in a feasibility study.

The DSS project team should have the major role in evaluating a proposed DSS project. The team should do the feasibility study and should evaluate the project regularly. A feasibility study is needed, but it may be very limited in the topics addressed (see Chapter 4). Canceling a project is always difficult, but managers can avoid this by actively managing DSS projects and by carefully evaluating the feasibility of proposed projects.

Large-scale DSS projects can be expensive. A data warehouse project can cost from $ 1 to $ 2 million and take from 1 to 3 years to complete. Business benefits can, however, be extensive. An International Data Corporation study (1996) of 62 firms found an average 3-year return on investment (ROI) of 401 percent, and the payback period can be very short.

A DSS can be a strategic system for a company; and project evaluation helps increase the chances of success and cost-effective implementation. Every DSS project has the same broad goal of providing some managers with the right information, in the right format, at the right time and at the right cost. So let's examine some tools that can help in the evaluation of this goal for a proposed DSS project.

EVALUATION TOOLS AND TECHNIQUES

For many years, business professors have been discussing the issues surrounding financial evaluation of capital expenditure projects. The argument continues. Typical evaluation tools recommended are ROI, Net Present Value (NPV), and discounted cash flow. These tools are closely tied to the capital budgeting process and are intended to provide a rational allocation of capital. This is a laudable goal.

Because managers are asked to spend funds on a DSS project, anticipated results and benefits should be quantified so that the requested expenditure can be evaluated in comparable units. But it is difficult to quantify the results and benefits of a DSS Project. DSS analysts are basically making estimates and guesses. A financial analysis is especially difficult because the costs are uncertain and many of the benefits are qualitative and intangible.

A number of alternative tools are available for evaluating DSS projects. Incremental value analysis is an evaluation of "soft" benefits, such as improving staff productivity, improving the speed of strategic actions, enhancing a company's competitive advantage, or improving access to data. Another alternative, the scoring approach, considers intangible benefits and other considerations that are not considered credible by analysts who only focus on financial criteria. A third alternative, the qualitative benefits scenario approach, attempts to estimate what decision making will be like when a proposed DSS is

in place and hence speculates on how the company will benefit. All of these qualitative approaches have pluses and minuses, but each can be improved by understanding the up-side and down-side of a DSS project. Table 12.1 lists six different evaluation tools and techniques.

Evaluation Tools and Techniques
1. Cost-Benefit Analysis
2. Cost-Effectiveness Analysis
3. Incremental Value Analysis
4. Qualitative Benefits Scenario Approach
5. Research and Development Options Approach
6. Scoring Approach

Table 12.1 – Summary of Evaluation Tools and Techniques

When choosing an evaluation method, many questions should be considered, including: Which tools work best? What technique should be used for this specific DSS project? Should different techniques be used for a data-driven than a model-driven DSS project? Does the cost of the project (amount of dollars to be spent) influence the best technique to be used?   The   next   few paragraphs assist in answering these questions and provide more details on the evaluation tools.

Cost-Benefit Analysis

The primary benefit of a DSS should be improved decisions. This intangible benefit presumes that managers will change their decision processes and actually use a new DSS. In a Sentry Market survey, 30 percent of respondents identified "access to data" as the biggest benefit of a data warehouse. Other important benefits of DSS and data warehouses include: improved data accuracy; better control of data; better data consistency; decentralization of data; cost savings; and less reliance on legacy systems. Few managers think that data warehouses will result in cost savings.

Typical measures in cost-benefit analysis (CBA) are ROI, NPV, and discounted cash flow. CBA is grounded in finance and accounting and closely tied to the budget process. This analysis addresses the allocation of capital and provides the appearance of accuracy and precision. CBA is useful for evaluating cost-savings projects and automation of current processes. CBA is difficult to

use for decision support, infrastructure, and strategic projects. For example, cost models for data warehouses are not available. Benefits are tough to measure. Benefits are not quantifiable or easily converted to dollars.

Examples of DSS cost factors include direct hardware and software costs, project personnel costs, support services (vendors or consultants), process change costs (people, material), and incremental infrastructure costs. Examples of DSS benefit factors include improved access to data, improved accuracy and consistency of data used in decision making, faster access to decision support, and cost savings from process improvements.

Both tangible and intangible costs and benefits can be identified. A cost or benefit is tangible if the consequences can be quantified. Intangible costs and benefits are difficult, and sometimes impossible to quantify. Intangible results need to be considered in an evaluation, but too many intangibles limit the validity of a CBA.

CBA is a systematic, quantitative method for assessing the life cycle costs and benefits of competing alternatives. It involves explicitly stating assumptions, disregarding sunk costs and prior results, estimating direct and indirect costs and benefits, discounting costs and benefits, and performing sensitivity analysis. Discounting involves calculating how much a dollar of costs or benefits is worth today, even though it will be realized in the future. Discounting calculates the time value of money.

A CBA commonly follows six steps:

1.   Define alternatives for the proposed project.
2.   Collect cost and benefit data.
3.   Document assumptions.
4.   Estimate costs and benefits (direct, indirect, tangible, intangible).
5.   Establish measurement criteria (especially for benefits).
6.   Evaluate all alternatives using NPV, benefit/cost ratio or payback.

The DSS Project Evaluator Decision Aid (see Figure 12.2), available at DSSResources.COM, may be useful in determining whether or not to implement a DSS. The program uses the annual operating cost, development cost, benefits, the number of users, and the discount rate to determine the long-term return, payback, benefit/cost ratio, and several other values important to consider when developing a DSS. The cost per user ratio is useful for determining how expensive the DSS is per person using the DSS. The benefit/cost ratio can be used to determine whether the total discounted benefits of the project are greater than the total discounted costs. Discounted means that they are adjusted for a fixed rate of inflation, the discount rate. If it is less than one, the total benefits are less than the total costs. The payback tells how many years it will take until overall benefits exceed overall costs. The LT (Long Term) return is the overall value of the DSS, excluding costs to develop the DSS.

DSS Project Evaluator

This Web-Based, Model-Driven DSS can help evaluate the Return on Investment (ROI) for a specific DSS project. Enter values under **Assumptions and Estimates** and then click **Calculate**. The results are then displayed. Use this decision support tool to test different sets of assumptions and to see results change.

Assumptions and Estimates

What is the cost of developing the new DSS? $ [   ]

What is the annual operating cost? $ [   ]

What are the anticipated total direct benefits per year? $ [   ]

What are the anticipated total indirect benefits per year? $ [   ]

How many users of the DSS?   [   ]

What is the discount rate?   [10.5   ] %

[Calculate]   [Reset]

Results

Cost per user (Year 1): $ [   ]   Total Cost (5 years): $ [   ]

Total Benefit (5 years): $ [   ]   LT Return: $ [   ]

Benefit/Cost Ratio: [   ]   Payback: [   ] years

Benefit/Cost Ratio -- When benefits equal costs the ratio is 1. Projects with ratios greater than one have benefits that exceed costs.

LT Return -- Long term return for the project is future benefits minus costs discounted to the present time.

Payback -- The payback calculation estimates how many years are needed for benefits to exceed costs of developing and operating the proposed DSS.

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Figure 12.2 – DSS Project Evaluator Decision Aid

Cost-Effectiveness Analysis

A cost-effectiveness analysis is a simplified CBA where one assumes that all of the alternatives have either the same benefits or the same costs. The analysis is simplified because only benefits or costs need to be calculated, not both. In this analysis, the best alternative is the one with the greatest benefits or the lowest cost. This type of analysis is sometimes more feasible when costs or benefits are hard, or would be expensive to measure.

Incremental Value Analysis

Peter Keen (1981) proposed a tool that is appropriate with rapid prototyping. This tool examines alternatives, stimulates new ideas, and asks, "what if?" The process is based on value, rather than emphasizing costs. The incremental value analysis process involves five steps:

1. Establish the operational list of benefits that the DSS must achieve to be acceptable.
2. Establish the maximum cost that one is willing to pay to achieve the benefits.
3. Build and assess prototype Version 0.
4. Establish cost and determine benefit threshold for Version 1.
5. Build Version 1; monitor benefits and costs and evolve to Version N.

The main advantages of the value analysis approach are that it is simple and easy to understand. The method attempts to reduce risk by requiring prototyping. Prototyping or staging can be very difficult for some DSS projects, especially data warehouse projects.

Qualitative Benefits Scenario Approach

Paul Schoemaker (1995), in "Scenario Planning: A Tool for Strategic Thinking," discusses a qualitative tool for evaluating information systems projects. This analysis tool helps executives imagine possible futures. Scenario planning is not "day dreaming," but rather, a rigorous process for assessing and preparing for the future. It helps executives estimate what decision making may be like when a proposed DSS is implemented. The steps include:

1. Identifying basic trends and uncertainties.
2. Constructing scenario themes.
3. Conducting quantitative research.
4. Developing decision scenarios.
5. Envisioning the DSS Project implemented.
6. Describing the use of the proposed DSS.
7. Discussing benefits that result from the new DSS.
8. Checking the scenario for consistency and plausibility.
9. Discussing risks and uncertainties.
10. Estimating the upper and lower bounds on costs and the development schedule.

A quantitative CBA is part of the qualitative benefits scenario approach, but the evaluation decision does not narrowly focus on only costs and benefits.

Research and Development Options Approach

In an article, "Uncovering the Hidden Value in High Risk Investments," David Sharp (1991) proposes a more complex "options" approach.

Options are valuable; they provide the ability to take advantage of certain opportunities at a later time. In real estate terminology, an option is a right purchased for a fee to buy or sell property within a specified time and at a specified price. The value of an option may actually increase with uncertainty and project duration. Options analysis should consider expenditures for both incremental DSS development and maintaining flexibility to build a future DSS. The research and development options approach has three steps:

1. Identify the options embedded in a given investment. What is done now incrementally to create future DSS opportunities?
2. Evaluate the environment and circumstances in which each might be exercised. Under what circumstances should more be invested in the proposed DSS?
3. Evaluate whether the total value of the options outweighs any shortfall in cash flow value from the expenditures; "How much would we be willing to pay now for this future flexibility and opportunity?"

This approach can be difficult to explain to managers and MIS staff. The key issue is expanding DSS opportunities. This method evaluates the proposed DSS as a research and development effort rather than as a capital investment.

Scoring Approach

Parker, Trainor, and Benson (1989) describe a method for evaluating IS projects called information economics that can be considered more generally as a decision analysis scoring approach. It considers intangible benefits and other considerations that are not considered credible by analysts who only focus on financial criteria. This approach uses the firm's business and IS strategic plans as part of an IS project evaluation. The process involves weighting factors to reflect how well the project satisfies a given factor. Points are assigned to each impact criterion. The scores are summarized; projects are ranked.

The process involves selecting a rating system to make numerical comparisons. Multiple raters evaluate each alternative on benefit and cost factors. Raters also weight the benefit and cost factors in terms of importance. Finally, an analyst calculates a weighted score for each alternative. Business justification of economic impact involves assessing strategic alignment, competitive advantage, management information support, competitive response to the project, and strategic or organizational risk. Technical viability involves examining the strategic systems architecture, technical uncertainty, and system infrastructure risk. A multi-factor evaluator decision aid is available at DSSResources.COM.

DSS PROJECT EVALUATION CRITERIA AND RISK FACTORS

Whitten, Bentley, and Barlow (1994) define four evaluation "tests" for IS projects:

Economic Test — a measure of the cost-effectiveness of a project or solution. This is often called a cost-benefit analysis. This test was discussed extensively in the prior section.

Operational Test — a measure of how well the solution of problems or a specific solution will work in the organization. It is also a measure of how people feel about the DSS proposal.

Schedule Test — a measure of the reasonableness of the project timetable. Can deadlines be met? Are milestones appropriate?

Technical Test — a measure of the practicality of a specific technical solution and the availability of technical resources and expertise. In some DSS proposals technical issues are the major risk concern.

Which of the criteria should be the focus at various project evaluation stages? The initial evaluation should focus on the project need and the anticipated benefits. The focus should be on the operational test. As the project evaluation continues, more feasibility issues need to be evaluated, and the benefits need to be assessed more carefully to insure that project advocates are not inflating benefits and minimizing problems. The economic test may be revisited a number of times, but it should be a major part of a feasibility analysis.

As noted in Chapter 2, 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. The schedule and technical tests are very important for such high-risk projects. Also, because the objectives of the project are ambiguous, it can be difficult to assess the return on the investment. When returns are hard to assess, more qualitative economic analyses are used.

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 size or scope of a DSS project in terms of the number of users served and the size of databases developed also has an impact on the risk of the assessed projects. Small DSS projects in terms of scope or cost tend to be of lower risk than large projects. Finally, the sophistication of the technology and the experience of the developers using the technology influence the overall project risk. The ultimate decision to invest in a DSS project should not be based solely on project risk. As noted in the discussion of gaining competitive advantage with innovative DSS projects, the project that is most likely to result in a competitive advantage is sometimes the riskiest project.

In general, evaluation activities and the application of the economic, operational, schedule and technical tests should be proportionate to the size/scope, complexity, and cost of a proposed DSS project. In narrow-scope DSS projects that impact few users and are highly structured, the amount of analysis and evaluation should often be limited, but as the project size and scope

increases and the project becomes less structured, project risk increases, and, hence, more frequent and more elaborate evaluation is needed. For large scope, low structure DSS projects, multiple detailed evaluations are probably needed and justified.

In all project evaluations, one needs to consider the longer term affects of short-term decisions that have been based solely upon short-horizon cost savings. DSS may reduce some costs, but that is not usually the motivating factor for a new system. No DSS project decision should be made in isolation. Even small projects can sometimes have million dollar impacts. It is important to broadly examine DSS project impacts. Once a DSS project is completed, managers need to follow up and periodically evaluate what is working well with the system and why, as well as assess problems that are being encountered.

INTERNATIONAL AND CULTURAL ISSUES

As companies expand into the global marketplace, DSS must assist managers from many nations. There are many issues and obstacles that need to be evaluated in considering such projects. Some of the obstacles to using technology to support decision making in global corporations include: accounting and currency issues, different regulations and import/export restrictions, lack of spontaneous or informal communication among individuals when using communications-driven DSS, the impersonality of electronic communications, cultural differences including languages and different work-hours, a multiplicity of technology standards, the possible lack of a telecommunications infrastructure, different interpretations of screen displays and terminology, and time zone differences. It may also be difficult to build trust and commitment among individuals who are primarily using electronic communications. The following section explores these issues in more detail.

Accounting and Currency Issues

Accounting and other business practices differ from country to country. This difference in standards makes getting accurate financial reports difficult. Currency conversion and fluctuations are another source of challenge in designing some DSS.

Culture

The purpose of a DSS is to inform decision makers, and ignoring cultural issues may create misinformation or misinterpretation. For example, not all cultures have the same assumptions about group decision making and hence the use of a Group DSS may be more effective in some settings than others. In some cultures, the norm is that all should have an equal voice in decision making. Some cultures encourage an open and collaborative problem-solving atmosphere. Some cultural norms support detailed meeting notes and a very structured decision-making process. The project team needs to consider such cultural issues.

Impersonality of Electronic Communication

In a global corporation, managers use information and communication technologies to overcome time and distance barriers. In the future, there will be fewer "real" face-to-face meetings and probably more interactive video face-to-face meetings. Bulletin boards will proliferate and email will be the dominant form of electronic communication. This change may isolate managers in different parts of a company. To keep from getting out of touch, managers need to work harder to communicate feelings and develop trust relationships. Communications-driven DSS should probably include pictures of participants and background materials.

Lack of Spontaneous or Informal Communication

When using a communications-driven DSS in a global corporation, much of the information sharing will probably involve e-mail, bulletin boards and other non-real-time methods of communication. Also, most of the communication will be written, and not face-to-face. This behavioral change means that there will be less spontaneous and informal communication in the company. This possibility and its consequences must be anticipated.

Language

English is the unofficial language of business and technology. The problem with accepting this conclusion about language usage when constructing a specific DSS is that it may create a communication barrier between managers. Knowledge of English varies widely, and American and British business English differs in terminology. Some countries, such as China, require that a certain percent of business documents be written in the native language. France requires that all public documents be written in French. DSS may need to be available in multiple languages, and definitions of key terms should be provided.

Regulations and Import/Export Restrictions

Some laws and regulations insist that a certain percentage of data collected in a country must be processed there. Also, some countries have data import/export restrictions. This makes it harder to aggregate all data assembled throughout the world. These restrictions can have a major impact on the design of data-driven DSS.

Screen Displays

Culture affects evaluations of DSS screen layout and design. Language can cause confusion in screen displays. Also, colors and icons may have different emotional and political meanings in different countries. For example, a red, octagonal sign is not universally interpreted to mean "stop."

Telecommunications Infrastructure

Telecommunications access, reliability, and standards differ from country to country. In many countries, the government owns or controls the communication industry and it may be difficult to install communication lines. Costs are also a factor. Costs for telecommunications in Europe may be 10 to 12 times more than in the United States. Some possible solutions to this are Virtual Private Networks and satellite systems. Technological infrastructure in different countries varies and constrains DSS implementation.

Time Zone Differences

There are 25 different time zones throughout the world. This makes it harder for companies to have real-time meetings and to have standard working hours for all of their employees. A dispersion of managers also means DSS need to be available at all times. Overcoming time zone impacts on decision making is difficult. In some ways, global managers need to never sleep, or at least function on short naps most of the time. Communications-driven DSS may reduce some of these impacts, but it cannot completely remove the problems.

One possible solution to many of the above issues is Information Systems Internationalization. Internationalization is the process of planning and implementing IS products and services so that they can easily be adapted to specific local languages and cultures. The internationalization process is sometimes called translation or localization. Localizing a DSS can include: allowing space in user interfaces for translation of text into languages that require more characters; developing DSS with products like Web editors or authoring tools that can support international character sets (Unicode); creating graphic images so that text labels can be translated inexpensively; creating flexible user interface designs; and using examples in help systems and software documentation that have a universal or global meaning. At a minimum, the above issues must be addressed in the evaluation of a proposed DSS that will have a global reach.

ETHICS AND PRIVACY ISSUES

Projects can fail for many reasons. A systematic evaluation process, and the appropriate use of evaluation tools can reduce project failures. One set of issues that can create problems is easy to minimize or overlook. These issues relate to the ethics of using a specific DSS or privacy issues raised by using specific data in a DSS. Both managers and MIS professionals need to be sensitive to ethics and privacy issues.

One might think that a DSS is ethically neutral and that project proposals shouldn't raise any moral or value issues. This view ignores the important role that principles and values play in making decisions. When model-driven or knowledge-driven DSS are constructed, developers make assumptions that can have ethical impacts on choices. For example, establishing a criterion or weight in a model may exclude inappropriately certain alternatives. Also, some

decisions are considered so value-laden that many people would be uncomfortable with developing a DSS to assist a decision maker. For example, a decision to commit suicide or have an abortion would involve serious moral or ethical issues. One cannot specify all of the ethical issues that might be relevant to a specific DSS proposal, but once a proposal reaches the feasibility stage, the project sponsor needs to specifically address the ethical issues associated with the project.

Privacy concerns are also easy to ignore during the evaluation of a DSS proposal. In many societies people expect that certain personal and behavioral information about them will be kept private. For example, in the United States, many people assume that religious donations and hospital records will be kept private. This information belongs to the person and doesn't belong to a company, the public, or the government. Managers need to insure that data used in DSS does not infringe on the privacy rights of individuals. The exact extent of privacy rights for employees, customers, and other data providers is not always clearly defined. In general, unless there is a clearly compelling reason to risk violating an individual's privacy, the "fence" to protect privacy of data should be higher and larger than minimum requirements.

CONCLUSIONS AND COMMENTARY

The World Wide Web has created a major opportunity to deliver more quantitative and qualitative information to decision makers. To exploit these opportunities and successfully implement innovative DSS, managers need to redesign business processes, integrate information technologies and associated information into decision-making processes, evaluate costs and benefits, and manage new types of business relationships. DSS projects must be evaluated in this broad context of corporate "readiness" (see Appendix I).

Learning enough to understand and evaluate an innovative DSS project is expensive. Managers and IS/IT staff need to do more than read a book. IS/IT staff should actually work with development tools prior to beginning a development project. The MIS unit may want to hire a consultant; staff should attend seminars, training sessions, and talk to vendors. The process of learning about innovative DSS opportunities will be time consuming and costly. Companies may need to spend a few hundred thousand dollars on a prototype or a departmental data mart. In firms with multi-million dollar IS/IT budgets, DSS prototype and data mart projects are needed and they should be viewed as "a learning experience". General managers need to spend enough money on DSS projects so that IS/IT managers and business managers can learn about the different types of DSS and can evaluate the costs and benefits and decide what is the most appropriate direction for their company (cf., Power, 1998).

In general, a detailed qualitative analysis of a proposed DSS at its initiation stage is the most that managers can reasonably expect. Although in some situations financial analysis tools can be useful, their use in evaluating a major DSS project provides only the appearance of accuracy and precision. When making a DSS project decision, managers should generally ask, "What are the expected results and benefits?" rather than "What is the anticipated ROI?"

Justifying DSS projects with ROI and NPV calculations is possible, but such an analysis does not accurately reflect the value of most DSS (cf., Baatz, 1996). Costs and benefits of DSS have an impact on many parts of an organization. In many ways the real benefits are created more by changes in the organization, than by the DSS itself. Managers should not necessarily demand a positive ROI from a Decision Support System project, but they *must* demand positive results.   Today, investigating innovative DSS projects is a business necessity. DSS can create competitive advantage and improve the operation and management of a company. Building DSS is an investment in improving the performance of a company, and such projects are excellent employee and corporate development experiences.