**How Decisions are Supported?**

Here we relate specific technologies to the decisionmaking process. Databases, data marts, and especially data warehouses are important technologies in supporting all phases of decision making. They provide the data that drive decision making.

**Support for the 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. 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 through 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.

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.

Expert systems (ES), in contrast, can render advice regarding the nature of a problem, its classification, its seriousness, and the like. ES can advise on the suitability of a solution approach and the likelihood of successfully solving the problem. One of the primary areas of ES success is interpreting information and diagnosing problems. This capability can be exploited in the intelligence phase. Even intelligent agents can be used to identify opportunities.

Much of the information used in seeking new opportunities is qualitative, or soft. This indicates a high level of unstructuredness in the problems, thus making DSS quite useful in the intelligence phase.

**Support for the Design Phase**

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. If a problem requires brainstorming to help identify important issues and options, a GSS may prove helpful. Tools that provide cognitive mapping can also help. Several Web-based tools that provide decision support, mainly in the design phase, by providing models and reporting of alternative results. Each of their cases has saved millions of dollars annually by utilizing these tools. Such DSS are helping engineers in product design as well as decision makers solving business problems.

**Support for the 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. 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.

**Support for the Implementation Phase**

This is where “making the decision happen” occurs. 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. For example, one chief executive officer (CEO) gives employees and external parties not only the aggregate financial goals and cash needs for the near term, but also the calculations, intermediate results, and statistics used in determining the aggregate figures. In addition to communicating the financial goals unambiguously, the CEO signals other messages. Employees know that the CEO has thought through the assumptions behind the financial goals and is serious about their importance and attainability. Bankers and directors are shown that the CEO was personally involved in analyzing cash needs and is aware of and responsible for the implications of the financing requests prepared by the finance department. Each of these messages improves decision implementation in some way.

Reporting systems and other tools variously labeled as BAM, BPM, KMS, EIS, ERP, CRM, and SCM are all useful in tracking how well an implementation is working. GSS is useful for a team to collaborate in establishing implementation effectiveness. For example, a decision might be made to get rid of unprofitable customers. An effective CRM can identify classes of customers to get rid of, identify the impact of doing so, and then verify that it really worked that way. All phases of the decision-making process can be supported by improved communication through collaborative computing via GSS and KMS. Computerized systems can facilitate communication by helping people explain and justify their suggestions and opinions.