Unit 6

ENHANCING DECISION MAKING OF THE MANAGEMENT

Lesson Structure

Contents

6.0 Objective

After going through this unit you should be able to

- Understand MIS and DSS
- Learn different types of Decision-Support System
- Know about the components of Decision-Support Systems
- Know about the role of DSS for Supply Chain Management
- Understand DSS for Customer Relationship Management
- Define Geographic Information Systems (GIS)
- Understand Web-Based Customer Decision-Support Systems
- Learn about Group Decision-Support Systems (GDSS)
- Learn about Executive Support Systems, its role and benefits

6.1 Introduction

A decision-support system (DSS) assists management decision-making by combining data, sophisticated analytical models and tools, and user-friendly software into a single powerful system that can support semistructured or unstructured decision-making. A DSS provides users with a flexible set of tools and capabilities for analyzing important blocks of data.

6.2 MIS and DSS

Some of the earliest applications for supporting management decision-making were management information systems (MIS). MIS primarily provide information on the firm's performance to help managers in monitoring and controlling the business. They typically produce fixed, regularly scheduled reports based on data extracted and summarized from the organization's underlying transaction processing systems (TPS). The format for these reports is often specified in advance. A typical MIS report might show a summary of monthly sales for each of the major sales territories of a company. Sometimes MIS reports are exception reports, highlighting only exceptional conditions, such as when the sales quotas for a specific territory fall below an anticipated level or employees who have exceeded their spending limit in a dental care plan. Traditional MIS produced primarily hard copy reports. Today these reports might be available on-line through an intranet, and more MIS reports can be generated on-demand.

DSS provide new sets of capabilities for nonroutine decisions and user control. An MIS provides managers with reports based on routine flows of data and assists in the general control of the

organization, whereas a DSS emphasizes change, flexibility, and a rapid response. With a DSS there is less of an effort to link users to structured information flows and a correspondingly greater emphasis on models, assumptions, ad hoc queries, and display graphics.

Structured problems are repetitive and routine, for which known algorithms provide solutions. Unstructured problems are novel and non routine, for which there are no algorithms for solutions. One can discuss, decide, and ruminate about unstructured problems, but they are not solved in the sense that one finds an answer to an equation. Semi structured problems fall between structured and unstructured problems. While MIS primarily address structured problems, DSS support semi structured and unstructured problem analysis.

6.3 Types of Decision-Support Systems

The earliest DSS tended to draw on small subsets of corporate data and were heavily model driven. Recent advances in computer processing and database technology have expanded the definition of a DSS to include systems that can support decision-making by analyzing vast quantities of data, including firm-wide data from enterprise systems and transaction data from the Web.

Today there are two basic types of decision-support systems, model-driven and data-driven. Model-driven DSS were primarily stand-alone systems isolated from major organizational information systems that used some type of model to perform "what-if" and other kinds of analyses. Such systems were often developed by end-user divisions or groups not under central IS control. Their analysis capabilities were based on a strong theory or model combined with a good user interface that made the model easy to use .

The second type of DSS is a data-driven DSS. These systems analyze large pools of data found in major organizational systems. They support decision-making by allowing users to extract useful information that was previously buried in large quantities of data. Often data from transaction processing systems (TPS) are collected in data warehouses for this purpose. On-line analytical processing (OLAP) and datamining can then be used to analyze the data. Companies are starting to build data-driven DSS to mine customer data gathered from their Web sites as well as data from enterprise systems.

The types of information that can be yielded from data mining are

- association
- sequences
- classifications
- clusters and
- forecasts.

Associations are occurrences linked to a single event. For instance, a study of supermarket purchasing patterns might reveal that when corn chips are purchased, a cola drink is purchased 65 percent of the time, but when there is a promotion, cola is purchased 85 percent of the time. With this information, managers can make better decisions because they have learned the profitability of a promotion.

In **sequences**, events are linked over time. One might find, for example, that if a house is purchased, then a new refrigerator will be purchased within two weeks 65 percent of the time, and an oven will be bought within one month of the home purchase 45 percent of the time.

Classification recognizes patterns that describe the group to which an item belongs by examining existing items that have been classified and by inferring a set of rules. For example, businesses such as credit card or telephone companies worry about the loss of steady customers. Classification can help discover the characteristics of customers who are likely to leave and can provide a model to help managers predict who they are so that they can devise special campaigns to retain such customers.

Clustering works in a manner similar to classification when no groups have yet been defined. A datamining tool will discover different groupings within data, such as finding affinity groups for bank cards or partitioning a database into groups of customers based on demographics and types of personal investments.

Although these applications involve predictions, **forecasting** uses predictions in a different way. It uses a series of existing values to forecast what other values will be. For example, forecasting might find patterns in data to help managers estimate the future value of continuous variables such as sales figures.

Datamining uses statistical analysis tools as well as neural networks, fuzzy logic, genetic algorithms, or rule-based and other intelligent techniques

6.4 Components of DSS

The main components of the DSS are the DSS database, the DSS software system, and the user interface. The DSS database may be a small database residing on a PC or a massive data warehouse.

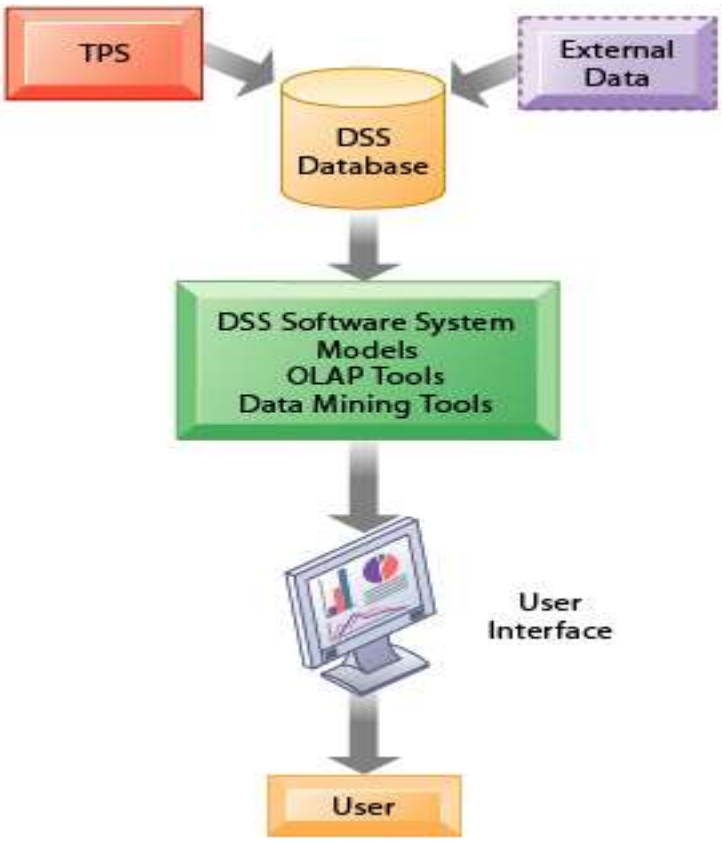

Figure 1: Overview of a decision-support system (DSS)

The main components of the DSS are the DSS database, the DSS software system, and the user interface. The DSS database may be a small database residing on a PC or a massive data warehouse.

The DSS database is a collection of current or historical data from a number of applications or groups. It may be a small database residing on a PC that contains a subset of corporate data that has been downloaded and possibly combined with external data. Alternatively, the DSS database may be a massive data warehouse that is continuously updated by major organizational TPS (including enterprise systems and data generated by Web site transactions). The data in DSS databases are generally extracts or copies of production databases so that using the DSS does not interfere with critical operational systems.

The DSS software system contains the software tools that are used for data analysis. It may contain various OLAP tools, datamining tools, or a collection of mathematical and analytical models that easily can be made accessible to the DSS user. A model is an abstract representation that illustrates the components or relationships of a phenomenon. A model can be a physical model (such as a model airplane), a mathematical model (such as an equation), or a verbal model (such as a description of a procedure for writing an order). Each decision-support system is built

for a specific set of purposes and will make different collections of models available depending on those purposes.

Perhaps the most common models are libraries of statistical models. Such libraries usually contain the full range of expected statistical functions including means, medians, deviations, and scatter plots. The software has the ability to project future outcomes by analyzing a series of data. Statistical modeling software can be used to help establish relationships, such as relating product sales to differences in age, income, or other factors between communities. Optimization models, often using linear programming, determine optimal resource allocation to maximize or minimize specified variables such as cost or time. A classic use of optimization models is to determine the proper mix of products within a given market to maximize profits.

Forecasting models often are used to forecast sales. The user of this type of model might supply a range of historical data to project future conditions and the sales that might result from those conditions. The decision-maker could vary those future conditions (entering, for example, a rise in raw materials costs or the entry of a new, low-priced competitor in the market) to determine how these new conditions might affect sales. Companies often use this software to predict the actions of competitors. Model libraries exist for specific functions, such as financial and risk analysis models.

Among the most widely used models are sensitivity analysis models that ask "what-if" questions repeatedly to determine the impact of changes in one or more factors on the outcomes. "What-if" analysis—working forward from known or assumed conditions—allows the user to vary certain values to test results in order to better predict outcomes if changes occur in those values.

The DSS user interface permits easy interaction between users of the system and the DSS software tools. A graphic, easy-to-use, flexible user interface supports the dialogue between the user and the DSS. The DSS users can be managers or employees with no patience for learning a complex tool, so the interface must be relatively intuitive .

6.5 DSS Applications and the Digital Firm

There are many ways in which DSS can be used to support decision-making. Table 6-1 lists examples of DSS in well-known organizations. Both data-driven and model-driven DSS have become very powerful and sophisticated, providing fine-grained information for decisions that enable the firm to coordinate both internal and external business processes much more precisely. Some of these DSS are helping companies improve supply chain management or plan scenarios for changing business conditions. Some can be used to fine-tune relationships with customers. Some take advantage of the company-wide data provided by enterprise systems. DSS today can also harness the interactive capabilities of the Web to provide decision-support tools to both employees and customers.

Organization	DSS Application
General Accident Insurance	Customer buying patterns and fraud detection
Bank of America	Customer profiles
Frito-Lay, Inc.	Price, advertising, and promotion selection
Burlington Coat Factory	Store location and inventory mix
KeyCorp	Targeting direct mail marketing customers
National Gypsum	Corporate planning and forecasting
Southern Railway	Train dispatching and routing
Texas Oil and Gas Corporation	Evaluation of potential drilling sites
United Airlines	Flight scheduling, passenger demand forecasting
U.S. Department of Defense	Defense contract analysis

6.6 DSS for Supply Chain Management

Supply chain decisions involve determining "who, what, when, and where" from purchasing and transporting materials and parts through manufacturing products and distributing and delivering those products to customers. DSS can help managers examine this complex chain comprehensively and search among a huge number of alternatives for the combinations that are most efficient and cost-effective. The prime management goal might be to reduce overall costs while increasing the speed and accuracy of filling customer orders.

In 1994 IBM Research developed an advanced supply chain optimization and simulation tool called the Asset Management Tool (AMT) to reduce inventory levels yet maintain enough inventory in the supply chain to respond quickly to customer demands. AMT deals with a range of entities in the supply chain, including targets for inventory and customer service levels, product structure, channel assembly, supplier terms and conditions, and lead-time reduction. Users of AMT can evaluate supply chains in terms of financial tradeoffs associated with various configurations and operational policies.

6.7 DSS for Customer Relationship Management

DSS for customer relationship management use data mining to guide decisions about pricing, customer retention, market share, and new revenue streams. These systems typically consolidate customer information from a variety of systems into massive data warehouses and use various analytical tools to slice it into tiny segments for one-to-one marketing.

6.8 Geographic Information Systems (GIS)

Geographic information systems (GIS) are a special category of DSS that can analyze and display data for planning and decision-making using digitized maps. The software can assemble, store, manipulate, and display geographically referenced information, tying data to points, lines, and areas on a map. GIS can thus be used to support decisions that require knowledge about the geographic distribution of people or other resources in scientific research, resource management, and development planning. For example, GIS might be used to help state and local governments calculate emergency response times to natural disasters or to help banks identify the best locations for installing new branches or ATM terminals. GIS tools have become affordable even for small businesses and some can be used on the Web.

6.9 Web-Based Customer Decision-Support Systems

The growth of electronic commerce has encouraged many companies to develop DSS where customers and employees can take advantage of Internet information resources and Web capabilities for interactivity and personalization. DSS based on the Web and the Internet can support decision-making by providing on-line access to various databases and information pools along with software for data analysis. Some of these DSS are targeted toward management, but many have been developed to attract customers by providing information and tools to assist their decision-making as they select products and services. Companies are finding that deciding which products and services to purchase has become increasingly information-intensive. People are now using more information from multiple sources to make purchasing decisions (such as purchasing a car or computer) before they interact with the product or sales staff. Customer decision-support systems (CDSS)support the decision-making process of an existing or potential customer.

6.10 Group Decision-Support Systems (GDSS)

Early DSS focused largely on supporting individual decision-making. However, because so much work is accomplished through groups within organizations, system developers and scholars began to focus on how computers can support group and organizational decision-making. A new category of systems developed known as group decision-support systems (GDSS).

6.10.1What Is a GDSS?

A group decision-support system (GDSS) is an interactive computer-based system to facilitate the solution of unstructured problems by a set of decision makers working together as a group (DeSanctis and Gallupe, 1987).

Groupware and Web-based tools for videoconferencing and electronic meetings described earlier in this text can support some group decision processes, but their focus is primarily on communication. This section focuses on the tools and technologies geared explicitly toward group decision-making. GDSS were developed in response to a growing concern over the quality and effectiveness of meetings. The underlying problems in group decision-making have been the explosion of decision-maker meetings, the growing length of those meetings, and the increased number of attendees. Estimates on the amount of a manager's time spent in meetings range from 35 percent to 70 percent.

Meeting facilitators, organizational development professionals, and information systems scholars have been focusing on this issue and have identified a number of discrete meeting elements that need to be addressed (Grobowski et al., 1990; Kraemer and King, 1988; Nunamaker et al., 1991). Among these elements are the following:

1.Improved preplanning, to make meetings more effective and efficient.

2.Increased participation, so that all attendees will be able to contribute fully even if the number of attendees is large. Free riding (attending the meeting but not contributing) must also be addressed.

3.Open, collaborative meeting atmosphere, in which attendees from various organizational levels feel able to contribute freely. The lower level attendees must be able to participate without fear of being judged by their management; higher status participants must be able to participate without having their presence or ideas dominate the meeting and result in unwanted conformity.

4.Criticism-free idea generation, enabling attendees to contribute without undue fear of feeling personally criticized.

5.Evaluation objectivity, creating an atmosphere in which an idea will be evaluated on its merits rather than on the basis of the source of the idea.

6.Idea organization and evaluation, which require keeping the focus on the meeting objectives, finding efficient ways to organize the many ideas that can be generated in a brainstorming session, and evaluating those ideas not only on their merits but also within appropriate time constraints.

7.Setting priorities and making decisions, which require finding ways to encompass the thinking of all the attendees in making these judgments.

8.Documentation of meetings, so that attendees will have as complete and organized a record of the meeting as may be needed to continue the work of the project.

9.Access to external information, which will allow significant, factual disagreements to be settled in a timely fashion, thus enabling the meeting to continue and be productive.

10.Preservation of "organizational memory," so that those who do not attend the meeting can also work on the project. Often a project will include teams at different locations who will need to understand the content of a meeting at only one of the affected sites.

One response to the problems of group decision-making has been the adoption of new methods of organizing and running meetings. Techniques such as facilitated meetings, brainstorming, and criticism-free idea generation have become popular and are now accepted as standard. Another response has been the application of technology to the problems resulting in the emergence of group decision-support systems.

6.10.2Characteristics of GDSS

How can information technology help groups arrive at decisions? Scholars have identified at least three basic elements of a GDSS: hardware, software tools, and people. Hardware refers to the conference facility itself, including the room, the tables, and the chairs. Such a facility must be physically laid out in a manner that supports group collaboration. It also must include some electronic hardware, such as electronic display boards, as well as audiovisual, computer, and networking equipment.

A wide range of software tools, including tools for organizing ideas, gathering information, ranking and setting priorities, and other aspects of collaborative work are being used to support decision-making meetings. We describe these tools in the next section. People refer not only to the participants but also to a trained facilitator and often to a staff that supports the hardware and software. Together these elements have led to the creation of a range of different kinds of GDSS, from simple electronic boardrooms to elaborate collaboration laboratories. In a collaboration laboratory, individuals work on their own desktop PCs or workstations. Their input is integrated on a file server and is viewable on a common screen at the front of the room; in most systems the integrated input is also viewable on the individual participant's screen.

6.10.3 GDSS Software Tools

Some features of groupware tools for collaborative work described in Chapters 6 and 10 can be used to support group decision-making. There also are specific GDSS software tools for supporting group meetings. These tools were originally developed for meetings in which all participants are in the same room, but they also can be used for networked meetings in which participants are in different locations. Specific GDSS software tools include the following:

Electronic questionnaires aid the organizers in pre-meeting planning by identifying issues of concern and by helping to ensure that key planning information is not overlooked

Electronic brainstorming tools allow individuals both simultaneously and anonymously, to contribute ideas on the topics of the meeting.

Idea organizers facilitate the organized integration and synthesis of ideas generated during brainstorming.

Questionnaire tools support the facilitators and group leaders as they gather information before and during the process of setting priorities.

Tools for voting or setting priorities make available a range of methods from simple voting, to ranking in order, to a range of weighted techniques for setting priorities or voting .

Stake holder identification and analysis tools use structured approaches to evaluate the impact of an emerging proposal on the organization and to identify stakeholders and evaluate the potential impact of those stakeholders on the proposed project.

Policy formation tools provide structured support for developing agreement on the wording of policy statements.

Group dictionaries document group agreement on definitions of words and terms central to the project.

6.11 Executive Support in the Enterprise

Executive support systems (ESS) also help managers with unstructured problems, focusing on the information needs of senior management. Combining data from internal and external sources, ESS create a generalized computing and communications environment that can be focused and applied to a changing array of problems. ESS help senior executives monitor organizational performance, track activities of competitors, spot problems, identify opportunities, and forecast trends.

6.11.1 The Role of Executive Support Systems in the Organization

Before ESS, it was common for executives to receive numerous fixed-format reports, often hundreds of pages every month (or even every week). Today, an ESS can bring together data from all parts of the organization and allow managers to select, access, and tailor them as needed using easy-to-use desktop analytical tools and on-line data displays. Use of the systems has migrated down several organizational levels so that the executive and any designated subordinates are able to look at the same data in the same way.

Today's systems try to avoid the problem of data overload so common in paper reports because the data can be filtered or viewed in graphic format (if the user so chooses). ESS systems have the ability to drill down, moving from a piece of summary data to lower and lower levels of detail. The ability to drill down is useful not only to senior executives but to employees at lower levels of the organization who need to analyze data. OLAP tools for analyzing large databases provide this capability.

A major challenge of building executive support systems has been to integrate data from systems designed for very different purposes so that senior executives can review organizational performance from a firm-wide perspective. Often data critical to the senior executive had been unavailable. For example, sales data coming from an order-entry transaction processing system might not be linked to marketing information, a linkage the executive would find useful. In the traditional firm, which typically had hundreds or even thousands of incompatible systems, pulling such information together and making sense out of it was a major task. When the information was assembled, it was likely to be out of date, incomplete and inaccurate. Making decisions under these conditions was like a dart game with the bulls-eye swinging on a pendulum. Today, properly configured and implemented enterprise systems can provide managers with timely, comprehensive, and accurate firm-wide information. Executive support systems based on such data can be considered logical extensions of enterprise system functionality.

External data, including data from the Web, now are more easily available in many ESS as well. Executives need a wide range of external data from current stock market news to competitor information, industry trends, and even projected legislative action. Through their ESS, many managers have access to news services, financial market databases, economic information, and whatever other public data they may require.

Contemporary ESS include tools for modeling and analysis. With only a minimum of experience, most managers find they can use these tools to create graphic comparisons of data by time, region, product, price range, and so on. (Whereas DSS use such tools primarily for modeling and analysis in a fairly narrow range of decision situations, ESS use them primarily to provide status information about organizational performance.)

6.11.2 Developing ESS

ESS are executive systems, and must be designed so that high-level managers and others can use them without much training. One area that merits special attention is the determination of executive information requirements. ESS needs to have some facility for environmental scanning. A key information requirement of managers at the strategic level is the capability to detect signals of problems in the organizational environment that indicate strategic threats and opportunities (Walls et al., 1992). The ESS needs to be designed so that both external and internal sources of information can be used for environmental scanning purposes.

Cost justification presents a different type of problem with an ESS. Because much of an executive's work is unstructured, how does one quantify benefits for a system that primarily supports such unstructured work? An ESS often is justified in advance by the intuitive feeling that it will pay for itself (Watson et al., 1991). If ESS benefits can ever be quantified, it is only after the system is operational.

6.11.3 Benefits of Executive Support Systems

Much of the value of ESS is found in their flexibility. These systems put data and tools in the hands of executives without addressing specific problems or imposing solutions. Executives are free to shape the problems as necessary, using the system as an extension of their own thinking processes. These are not decision-making systems; they are tools to aid executives in making decisions.

The most visible benefit of ESS is their ability to analyze, compare, and highlight trends. The easy use of graphics allows the user to look at more data in less time with greater clarity and insight than paper-based systems can provide. In the past, executives obtained the same information by taking up days and weeks of their staffs' valuable time. By using ESS, those staffs and the executives themselves are freed up for the more creative analysis and decision-making in their jobs. ESS capabilities for drilling down and highlighting trends also may enhance the quality of such analysis and can speed up decision-making (Leidner and Elam, 1993–1994).

Executives are using ESS to monitor performance more successfully in their own areas of responsibility. Some companies are using these systems to monitor key performance indicators for the entire firm and to measure firm performance against changes in the external environment. The timeliness and availability of the data result in needed actions being identified and taken earlier. Problems can be handled before they become too damaging; opportunities can also be identified earlier. These systems can thus help organizations move toward a "sense and respond" strategy.

A well-designed ESS could dramatically improve management performance and increase upper management's span of control. Immediate access to so much data allows executives to better monitor activities of lower units reporting to them. That very monitoring ability could allow decision-making to be decentralized and to take place at lower operating levels. Executives are often willing to push decision-making further down into the organization as long as they can be assured that all is going well. Alternatively, executive support systems based on enterprise-wide data could potentially increase management centralization, enabling senior executives to monitor the performance of subordinates across the company and direct them to take appropriate action when conditions change.

6.11.4Executive Support Systems and the Digital Firm

To illustrate the different ways in which an ESS can enhance management decision-making, we now describe important types of ESS applications for gathering business intelligence and monitoring corporate performance, including ESS based on enterprise systems.

6.11.5 ESS for Business Intelligence

Today, customer expectations, Internet technology, and new business models can alter the competitive landscape so rapidly that managers need special capabilities for competitive intelligence-gathering. ESS can help managers identify changing market conditions, formulate responses, track implementation efforts, and learn from feedback.

BP Sony NV, the Netherlands branch of the multinational electronics giant, wanted more insight from the marketplace to drive its competitive strategy. Until recently, its management reports were based primarily on financial and administrative data that took at least 24 hours to generate. Management wanted to be able to make meaningful decisions based on marketing and sales data as well so it could respond quickly to marketplace changes. Sony Netherlands constructed a data warehouse and Executive Information System for this purpose.

The system is now available to 78 users in management, marketing, and sales. They can use the system to help them define strategies, search for opportunities, identify problems, and substantiate actions. Using a drill-down function, they can examine the underlying numbers behind the total result. For instance, while senior management can obtain sales results by business unit or product group, a marketing manager can use the system to look only at the group of products he or she was responsible for. The manager can produce a report to indicate exactly which products are strong or weak performers or to rank dealers by performance. The system is flexible, easy to use, and can provide much of this information to the user on-line (Information Builders, 2000).

6.12 Summary

Management is responsible for determining where management support systems can make their greatest contribution to organizational performance and for allocating the resources to build them. Management needs to work closely with system builders to make sure that these systems effectively capture the right set of information requirements and decision processes for guiding the firm.

Management support systems can improve organizational performance by speeding up decision-making or improving the quality of management decisions. However, some of these decision processes may not be clearly understood. A management support system will be most effective when system builders have a clear idea of its objectives, the nature of the decisions to be supported, and how the system will actually support decision-making.

Systems to support management decision-making can be developed with a range of technologies, including the use of large databases, modeling tools, graphics tools, datamining and analysis tools, and electronic meeting technology. Identifying the right technology for the decision or decision process to be supported is a key technology decision.

6.13Questions for Exercise

Q1) Define DSS and discuss its characteristics and capabilities.

Q2) How MIS and DSS are related. Discuss the different types of DSS.

Q3) Discuss the components of DSS and its application in digital firm.

Q4)Discuss DSS for Supply Chain Management and Customer Relationship Management.

Q5)Write short notes on

a) Geographic Information System
b) Web-Based Customer Decision-Support Systems

Q6) Define GDSS , its characteristics and Software tools.

Q7) What do you mean by Executive support systems (ESS) and discuss its role in the organization.

Q8) Discuss ESS for Business Intelligence.

6.14 Further Reading

1)J. O'Brian, Management Information Systems: Managing Information Technology in the Networked Enterprise (3rd Ed), Irwin, 1996.

2) Robert Schultheis & Mary Sumner, Management Information Systems-The Manager's View, Tata McGraw Hill, New Delhi

3) Management Information Systems, Loudon and Loudon, 10th edition, Pearsons Educations

4) Management Information Systems, Jaswal Oxford Press