

## Unit 7 - Supporting Decision Making

### Decision support in business

- To succeed in business today, companies need information systems that can support the diverse information and decision-making needs of their managers and business professionals.
- As companies migrate toward responsive e-business models, they are investing in new data-driven decision support application frameworks that help them respond rapidly to changing market conditions and customer needs.

### Information, decisions, and management

**FIGURE 10.2** Information requirements of decision makers. The type of information required by directors, executives, managers, and members of self-directed teams is directly related to the level of management decision making involved and the structure of decision situations they face.



- Figure above emphasizes that the type of information required by decision makers in a company is directly related to the **level of management decision making** and the amount of structure in the decision situations they face.
- It is important to understand that the framework of the classic **managerial pyramid** shown in figure above applies even in today's **downsized organizations** and **flattened** or nonhierarchical organizational structures.
- Levels of management decision making still exist, but their size, shape, and participants continue to change as today's fluid organizational structures evolve.
- Thus, the levels of managerial decision making that must be supported by information technology in a successful organization are:
  - **Strategic Management**
    - Typically, a board of directors and an executive committee of the CEO and top executives develop overall organizational goals, strategies, policies, and objectives as part of a strategic planning process.
    - They also monitor the strategic performance of the organization and its overall direction in the political, economic, and competitive business environment.

- **Tactical Management**

- Increasingly, business professionals in self-directed teams as well as business unit managers develop short- and medium-range plans, schedules, and budgets and specify the policies, procedures, and business objectives for their subunits of the company.
- They also allocate resources and monitor the performance of their organizational subunits, including departments, divisions, process teams, project teams, and other workgroups.

- **Operational Management**

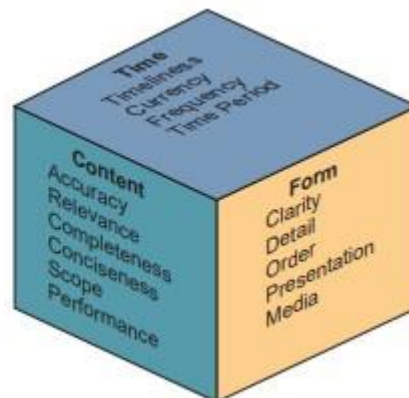
- The members of self-directed teams or operating managers develop short-range plans such as weekly production schedules.
- They direct the use of resources and the performance of tasks according to procedures and within budgets and schedules they establish for the teams and other workgroups of the organization.

### Information Quality

- What characteristics of information products make them valuable and useful to you?
- To answer this important question, we must first examine the characteristics or attributes of **information quality**.
- Information that is outdated, inaccurate, or hard to understand is not very meaningful, useful, or valuable to you or other business professionals.
- People need information of high quality, that is, information products whose characteristics, attributes, or qualities make the information more valuable to them.
- It is useful to think of information as having the three dimensions of time, content, and form.
- Figure below summarizes the important attributes of information quality and groups them into these three dimensions.

**FIGURE 10.3**

A summary of the attributes of information quality. This figure outlines the attributes that should be present in high-quality information products.



<b>Time Dimension</b>	
Timeliness	Information should be provided when it is needed.
Currency	Information should be up-to-date when it is provided.
Frequency	Information should be provided as often as needed.
Time Period	Information can be provided about past, present, and future time periods.
<b>Content Dimension</b>	
Accuracy	Information should be free from errors.
Relevance	Information should be related to the information needs of a specific recipient for a specific situation.
Completeness	All the information that is needed should be provided.
Conciseness	Only the information that is needed should be provided.
Scope	Information can have a broad or narrow scope, or an internal or external focus.
Performance	Information can reveal performance by measuring activities accomplished, progress made, or resources accumulated.
<b>Form Dimension</b>	
Clarity	Information should be provided in a form that is easy to understand.
Detail	Information can be provided in detail or summary form.
Order	Information can be arranged in a predetermined sequence.
Presentation	Information can be presented in narrative, numeric, graphic, or other forms.
Media	Information can be provided in the form of printed paper documents, video displays, or other media.

## Decision Structure

- One way to understand decision making is to look at **decision structure**.
- Decisions made at the operational management level tend to be more structured, those at the tactical level are more semistructured, and those at the strategic management level are more unstructured.
- Structured decisions involve situations in which the procedures to follow, when a decision is needed, can be specified in advance. The inventory reorder decisions that most businesses face are a typical example.
- Unstructured decisions involve decision situations in which it is not possible to specify in advance most of the decision procedures to follow. Most decisions related to long-term strategy can be thought of as unstructured (e.g., "What product lines should we develop over the next five years?").
- Most business decision situations are semi-structured; that is, some decision procedures can be pre-specified but not enough to lead to a definite recommended decision. For example, decisions involved in starting a new line of e-commerce services or making major changes to employee benefits would probably range from unstructured to semistructured.
- Finally, decisions that are unstructured are those for which no procedures or rules exist to guide the decision makers toward the correct decision. In these types of decisions, many sources of information must be accessed, and the decision often rests on experience and "gut feeling."
- One example of an unstructured decision might be the answer to the question, "What business should we be in 10 years from now?"
- Figure below provides a variety of examples of business decisions by type of decision structure and level of management.

FIGURE 10.4 Examples of decisions by the type of decision structure and level of management.

Decision Structure	Operational Management	Tactical Management	Structure Management
Unstructured	Cash management	Business process reengineering	New e-business initiatives
		Workgroup performance analysis	Company reorganization
Semistructured	Credit management	Employee performance appraisal	Product planning
	Production scheduling	Capital budgeting	Mergers and acquisitions
	Daily work assignment	Program budgeting	Site location
Structured	Inventory control	Program control	

- Therefore, information systems must be designed to produce a variety of information products to meet the changing needs of decision makers throughout an organization.
- For example, decision makers at the strategic management level may look to **decision support systems** to provide them with more summarized, ad hoc, unscheduled reports, forecasts, and external intelligence to support their more unstructured planning and policymaking responsibilities.
- Decision makers at the operational management level, in contrast, may depend on **management information systems** to supply more prespecified internal reports emphasizing detailed current and historical data comparisons that support their more structured responsibilities in day-to-day operations.

## MIS vs DSS

FIGURE 10.5 Comparing the major differences in the information and decision support capabilities of management information systems and decision support systems.

	Management Information Systems	Decision Support Systems
• Decision support provided	Provide information about the performance of the organization	Provide information and decision support techniques to analyze specific problems or opportunities
• Information form and frequency	Periodic, exception, demand, and push reports and responses	Interactive inquiries and responses
• Information format	Prespecified, fixed format	Ad hoc, flexible, and adaptable format
• Information processing methodology	Information produced by extraction and manipulation of business data	Information produced by analytical modeling of business data

## Decision Support Trends

- During the 1990s, however, both academic researchers and business practitioners began to report that the traditional managerial focus originating in classic management information systems (1960s), decision support systems (1970s), and executive information systems (1980s) was expanding.
- The fast pace of new information technologies like PC hardware and software suites, client/server networks, and networked PC versions of DSS software made decision support available to lower levels of management, as well as to nonmanagerial individuals and self-directed teams of business professionals.

- This trend has accelerated with the dramatic growth of the Internet, as well as of intranets and extranets that inter-network with companies and their stakeholders.
- The e-business and e-commerce initiatives that are being implemented by many companies are also expanding the information and decision support uses and the expectations of a company's employees, managers, customers, suppliers, and other business partners.
- In addition, this dramatic expansion has opened the door to the use of such **business intelligence (BI)** tools by the suppliers, customers, and other business stakeholders of a company for customer relationship management, supply chain management, and other ebusiness applications.

### **Business Intelligence (BI)**

- In 1989, Howard Dresner (later a Gartner Group analyst) proposed BI as an umbrella term to describe "concepts and methods to improve business decision making by using factbased support systems."
- Today, BI is considered a necessary and mission critical element in crafting and executing a firm's strategy.
- BI is rapidly becoming the mainstay for business decision making in the modern organization.
- Before long, it will evolve into a competitive necessity for many industries.
- As with all concepts in business-related technologies, business intelligence has evolved from Dresner's original definition focusing on concepts and methods to a more actionoriented approach referred to as **business analytics**.

### **Business Analytics (BA)**

- Business analytics (BA) refers to the skills, technologies, applications, and practices applied to a continuous iterative exploration and investigation of a business's historical performance to gain insight and drive the strategic business planning process.
- Business analytics focuses on developing new insights and understanding of business performance based on data and statistical methods.
- In contrast, business intelligence traditionally focuses on using a consistent set of metrics to both measure past performance and guide business planning, which is also based on data and statistical methods.
- Business analytics makes much more extensive use of data, statistical and quantitative analysis, explanatory and predictive modeling, and fact-based management to drive decision making.
- Analytics may be used as input for human decisions or may drive fully automated decisions.

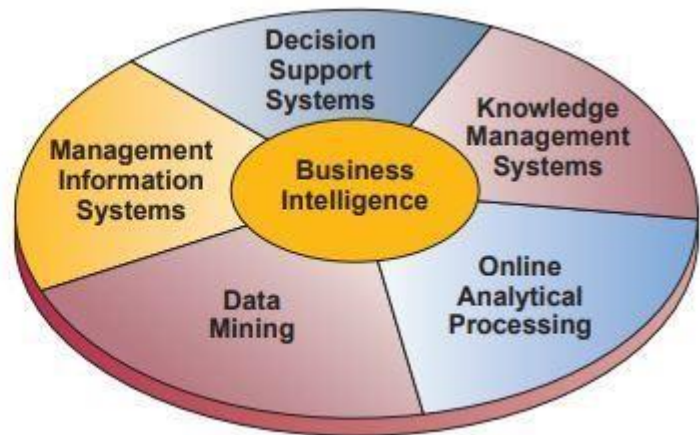
### **BI vs BA**

- Business intelligence is more associated with querying, reporting, online analytical processing (OLAP), and "alerts."
- In other words, querying, reporting, OLAP, and alert tools can answer the questions: **what happened; how many; how often; where; where exactly is the problem;** and **what**

**actions are needed.** Business analytics, in contrast, can answer the questions: **why is this happening; what if these trends continue; what will happen next (that is, predict);** and **what is the best that can happen (that is, optimize).**

- One of the most common techniques and approaches associated with business analytics is data mining.
- Figure below highlights several major information technologies that are being customized, personalized, and Web-enabled to provide key business information and analytical tools for managers, business professionals, and business stakeholders.

**FIGURE 10.7**  
Business intelligence applications are based on personalized and Web-enabled information analysis, knowledge management, and decision support technologies.



### Decision Support Systems

- Decision support systems are computer-based information systems that provide interactive information support to managers and business professionals during the decision making process.
- Decision support systems use:
  1. analytical models,
  2. specialized databases,
  3. a decision maker's own insights and judgments, and
  4. an interactive, computer-based modeling process to support semi structured business decisions.

### Example

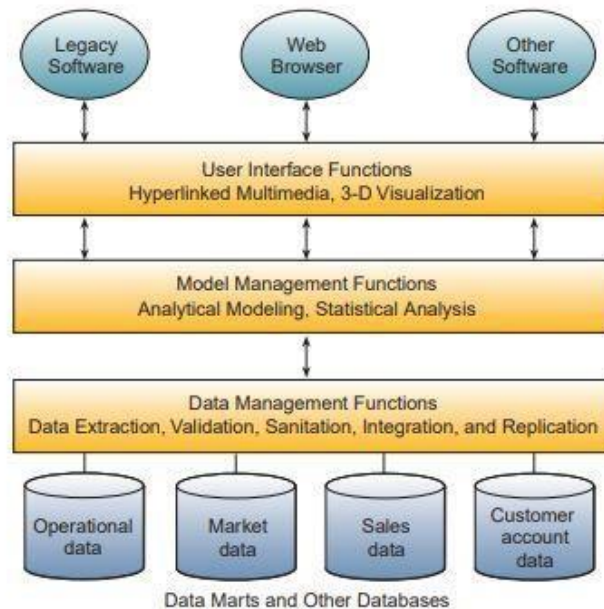
Sales managers typically rely on management information systems to produce sales analysis reports. These reports contain sales performance figures by product line, salesperson, sales region, and so on. A decision support system (DSS), however, would also interactively show a sales manager the effects on sales performance of changes in a variety of factors (e.g., promotion expense and salesperson compensation). The DSS could then use several criteria (e.g., expected gross margin and market share) to evaluate and rank alternative combinations of sales performance factors.

- Therefore, DSS are designed to be ad hoc, quick-response systems that are initiated and controlled by business decision makers.
- Decision support systems are thus able to support directly the specific types of decisions and the personal decision-making styles and needs of individual executives, managers, and business professionals.

## DSS Components

- Unlike management information systems, decision support systems rely on model bases, as well as databases, as vital system resources.
- A DSS model base is a software component that consists of models used in computational and analytical routines that mathematically express relationships among variables.
- For example, a spreadsheet program might contain models that express simple accounting relationships among variables, such as Revenue, Expenses and Profit.
- A DSS model base could also include models and analytical techniques used to express much more complex relationships.
- For example, it might contain linear programming models, multiple regression forecasting models, and capital budgeting present value models.
- Such models may be stored in the form of spreadsheet models or templates, or statistical and mathematical programs and program modules.

**FIGURE 10.8**  
Components of a Web-enabled marketing decision support system. Note the hardware, software, model, data, and network resources involved.

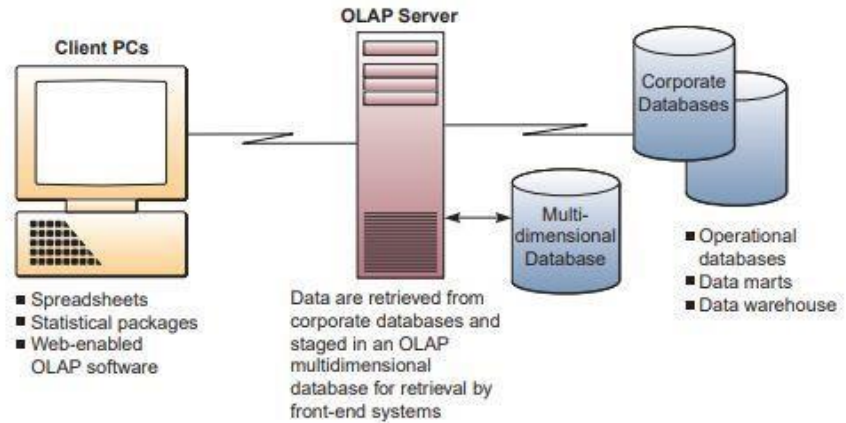


## Online Analytical Processing

- Online analytical processing enables managers and analysts to interactively examine and manipulate large amounts of detailed and consolidated data from many perspectives.
- OLAP involves analyzing complex relationships among thousands or even millions of data items stored in data marts, data warehouses, and other multidimensional databases to discover patterns, trends, and exception conditions.
- An OLAP session takes place online in real time, with rapid responses to a manager's or analyst's queries, so that the analytical or decision-making process is undisturbed.

**FIGURE 10.11**

Online analytical processing may involve the use of specialized servers and multidimensional databases. OLAP provides fast answers to complex queries posed by managers and analysts using traditional and Web-enabled OLAP software.



## OLAP Operations

- OLAP provides a user-friendly environment for interactive data analysis. One of the most popular front-end applications for OLAP is a PC spreadsheet program.
- Some popular OLAP operations for multidimensional data are:- **1. Roll-up (drill-up)**
- The roll-up operation performs aggregation on a data cube either by climbing up the hierarchy or by dimension reduction.
- Consider an example:-

Location	Medal
Delhi	5
New York	2
Patiala	3
Los Angeles	5

- Delhi, New York, Patiala and Los Angeles wins 5, 2, 3 and 5 medals respectively. So in this example, we roll upon Location from cities to countries.

Location	Medal
India	8
America	7

### 2. Drill-down

- Drill-down is the reverse of roll-up. That means lower level summary to higher level summary.
- Drill-down can be performed either by:-
  - a. Stepping down a concept hierarchy for a dimension
  - b. By introducing a new dimension.
- Consider an example:-



Location	Medal
India	8
America	7

- Drill-down on Location from countries to cities.

Location	Medal
Delhi	5
New York	2
Patiala	3
Los Angeles	5

### 3. Slice and dice

- The slice operation performs a selection on one dimension of the given cube, resulting in a subcube.
- Reduces the dimensionality of the cubes.
- For example, if we want to make a select where Medal = 5

Location	Medal
Delhi	5
Los Angeles	5

Slice Operation

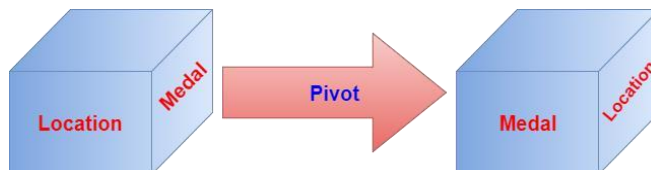
- The dice operation defines a sub-cube by performing a selection on two or more dimensions.
- For example, if we want to make a select where Medal = 3 or Location = New York

Location	Medal
Patiala	3
New York	2

Dice Operation

### 4. Pivot

- Pivot is also known as rotate.
- It rotates the data axis to view the data from different perspectives.



Pivot

## OLAP Uses

- Common business areas where OLAP can solve complex problems include
  - o Marketing and sales analysis
  - o Clickstream data
  - o Database marketing
  - o Budgeting
  - o Financial reporting and consolidation
  - o Profitability analysis
  - o Quality analysis

## Q. Explain the various examples of OLAP.

### Using Decision Support Systems

- A decision support system involves an interactive **analytical modeling** process.
- For example, using a DSS software package for decision support may result in a series of displays in response to alternative what-if changes entered by a manager.
- This differs from the demand responses of management information systems because decision makers are not demanding prespecified information; rather, they are exploring possible alternatives.
- Thus, they do not have to specify their information needs in advance.
- Instead, they use the DSS to find the information they need to help them make a decision.
  - This is the essence of the decision support system concept.
- Four basic types of analytical modeling activities are involved in using a decision support system:
  1. what-if analysis,
  2. sensitivity analysis,
  3. goal-seeking analysis, and
  4. optimization analysis

### 1. What-If Analysis

- In what-if analysis, a user makes changes to variables, or relationships among variables, and observes the resulting changes in the values of other variables.
- For example, if you were using a spreadsheet, you might change a revenue amount (a variable) or a tax rate formula (a relationship among variables) in a simple financial spreadsheet model. Then you could command the spreadsheet program to recalculate all affected variables in the spreadsheet instantly.
- A managerial user would be able to observe and evaluate any changes that occurred to the values in the spreadsheet, especially to a variable such as net profit after taxes.
- To many managers, net profit after taxes is an example of the **bottom line**, that is, a key factor in making many types of decisions.

- This type of analysis would be repeated until the manager was satisfied with what the results revealed about the effects of various possible decisions.

## **2. Sensitivity Analysis**

- Sensitivity analysis is a special case of what-if analysis.
- Typically, the value of only one variable is changed repeatedly, and the resulting changes on other variables are observed.
- As such, sensitivity analysis is really a case of what-if analysis that involves repeated changes to only one variable at a time.
- Typically, decision makers use sensitivity analysis when they are uncertain about the assumptions made in estimating the value of certain key variables.
- In our previous spreadsheet example, the value of revenue could be changed repeatedly in small increments, and the effects on other spreadsheet variables observed and evaluated. This process would help a manager understand the impact of various revenue levels on other factors involved in decisions being considered.
- A typical example might be determining at what point the interest rate on a loan makes a project no longer feasible. By varying the interest rate used in a net present value calculation, for example, a manager can determine the range of acceptable interest rates under which a project can move forward. Approaching the problem this way allows the manager to make decisions about a forthcoming project without knowing the actual cost of the money being borrowed.

## **3. Goal Seeking Analysis**

- Goal-seeking analysis reverses the direction of the analysis done in what-if and sensitivity analyses.
- Instead of observing how changes in a variable affect other variables, goal-seeking analysis (also called how-can analysis) sets a target value (goal) for a variable and then repeatedly changes other variables until the target value is achieved.
- For example, you could specify a target value (goal) of \$2 million in net profit after taxes for a business venture. Then you could repeatedly change the value of revenue or expenses in a spreadsheet model until you achieve a result of \$2 million.
- Goal-seeking analysis is another important method of decision support.

## **4. Optimization Analysis**

- Optimization analysis is a more complex extension of goal-seeking analysis.
- Instead of setting a specific target value for a variable, the goal is to find the optimum value for one or more target variables, given certain constraints.
- Then one or more other variables are changed repeatedly, subject to the specified constraints, until you discover the best values for the target variables.
- For example, you could try to determine the highest possible level of profits that could be achieved by varying the values for selected revenue sources and expense categories.

- Changes to such variables could be subject to constraints, such as the limited capacity of a production process or limits to available financing.

### **Data Mining for Decision Support**

- The main role of data mining is to provide decision support to managers and business professionals through a process referred to as **knowledge discovery**.
- Data mining software analyzes the vast stores of historical business data that have been prepared for analysis in corporate data warehouses and tries to discover patterns, trends, and correlations hidden in the data that can help a company improve its business performance.
- Data mining software may perform regression, decision tree, neural network, cluster detection, or market basket analysis for a business.
- The data mining process can highlight buying patterns, reveal customer tendencies, cut redundant costs, or uncover unseen profitable relationships and opportunities.
- For example, many companies use data mining to find more profitable ways to perform successful direct mailings, including e-mailings, or discover better ways to display products in a store, design a better ecommerce website, reach untapped profitable customers, or recognize customers or products that are unprofitable or marginal.

**Q. Explain about Market basket analysis (MBA). What are the applications of MBA?**