

## **Unit 7: Supporting Decision Making LH 6**

- Decision support in business
- Information, decisions, and management
- Information quality
- Decision structure, decision support trends, decision support systems
- Online analytical processing: OLAP examples
- Using decision support systems: what-if analysis, sensitivity analysis, goal-seeking analysis,
- Optimization analysis, data mining for decision support

- **Learning Objectives**
  - **What are the different types of decisions and how does the decision-making process work?**
  - **How do information systems support the activities of managers and management decision making?**
  - **How do business intelligence and business analytics support decision making?**
  - **How do different decision-making constituencies in an organization use business intelligence?**
  - **What is the role of information systems in helping people working in a group make decisions more efficiently?**

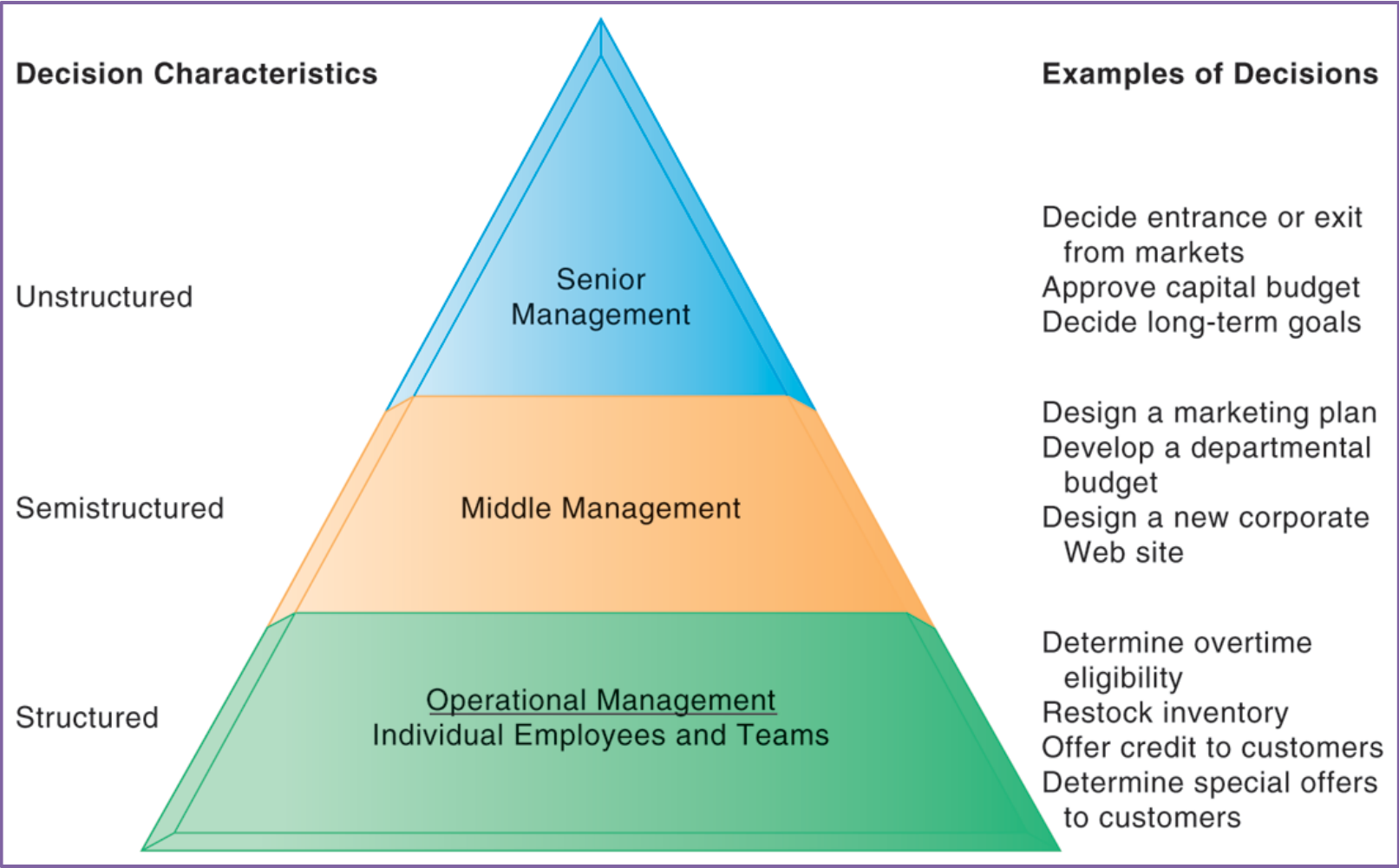
- What to Sell? What Price to Charge? Ask the Data
  - **Problem:** Chain retailers such as Starbucks, Duane Reade, need to determine what products will sell at what prices at different locations
  - **Solutions:** Business analytics software to analyze patterns in sales data, create pricing profiles and buyer profiles for different regions, locales, even times of day
  - Demonstrates the use of business intelligence and analysis systems to improve sales and profits
  - Illustrates how information systems improve decision making

- Decision Making and Information Systems
  - **Business value of improved decision making**
    - Improving hundreds of thousands of “small” decisions adds up to large annual value for the business.
  - **Types of decisions:**
    - **Unstructured:** Decision maker must provide judgment, evaluation, and insight to solve problem
    - **Structured:** Repetitive and routine; involve definite procedure for handling so they do not have to be treated each time as new
    - **Semistructured:** Only part of problem has clear-cut answer provided by accepted procedure.

- Decision Making and Information Systems
  - **Senior managers:**
    - Make many unstructured decisions
    - E.g. Should we enter a new market?
  - **Middle managers:**
    - Make more structured decisions but these may include unstructured components
    - E.g. Why is order fulfillment report showing decline in first quarter?
  - **Operational managers, rank and file employees**
    - Make more structured decisions
    - E.g. Does customer meet criteria for credit?

- Decision Making and Information Systems

**INFORMATION REQUIREMENTS OF KEY DECISION-MAKING GROUPS IN A FIRM**



**FIGURE 12-1** Senior managers, middle managers, operational managers, and employees have different types of decisions and information requirements.

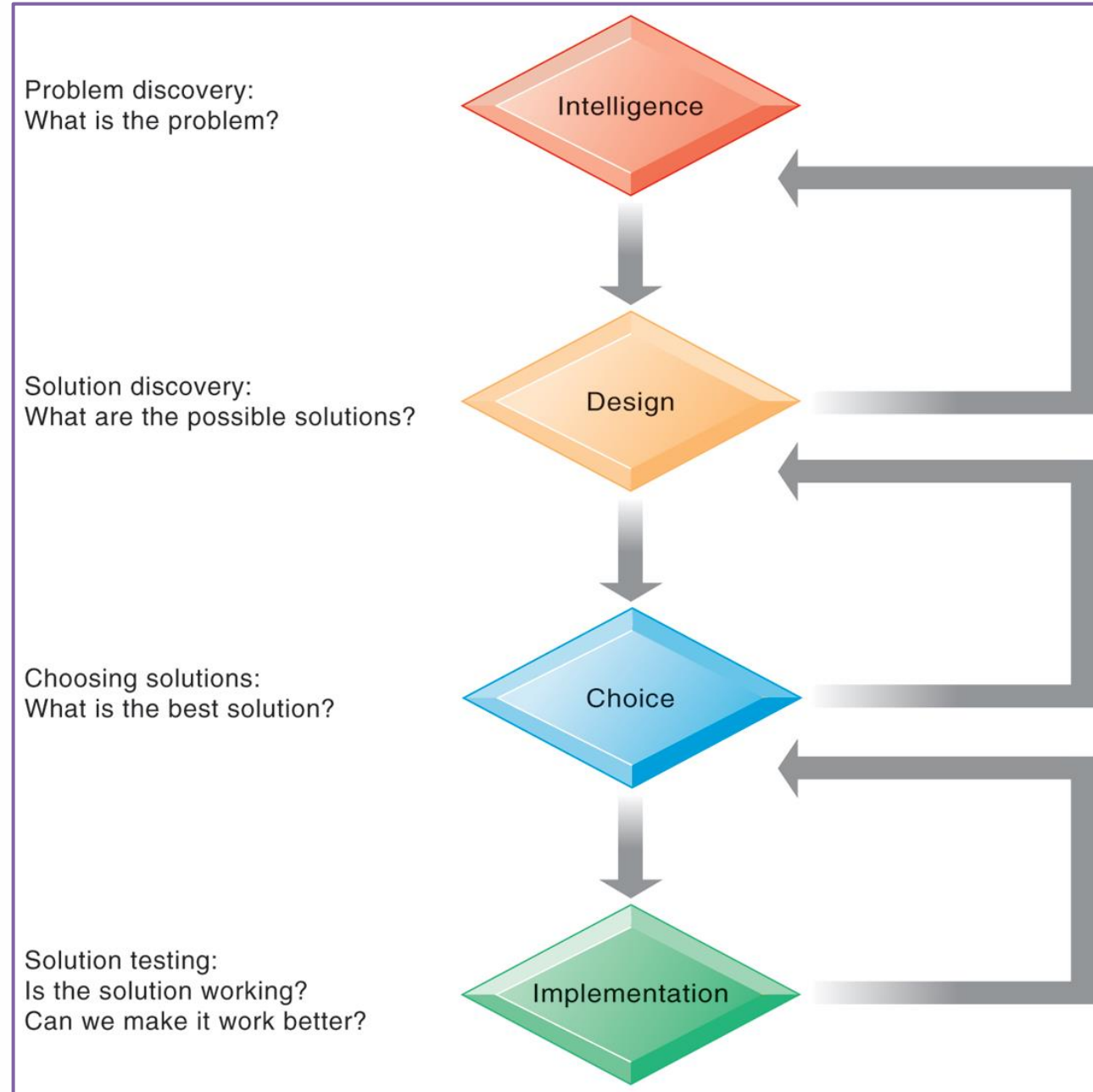
- Decision Making and Information Systems
  - **The 4 stages of the decision making process**
    - 1. Intelligence**
      - Discovering, identifying, and understanding the problems occurring in the organization
    - 2. Design**
      - Identifying and exploring solutions to the problem
    - 3. Choice**
      - Choosing among solution alternatives
    - 4. Implementation**
      - Making chosen alternative work and continuing to monitor how well solution is working

# Decision Making and Information Systems

## STAGES IN DECISION MAKING

The decision-making process is broken down into four stages.

FIGURE 12-2





# Decision Making and Information Systems

- Information systems can only assist in some of the roles played by managers
- Classical model of management: 5 functions
  - Planning, organizing, coordinating, deciding, and controlling
- More contemporary behavioral models
  - Actual behavior of managers appears to be less systematic, more informal, less reflective, more reactive, and less well organized than in classical model

- **Decision Making and Information Systems**

**A) Interpersonal cluster includes:**

- 1- Figurehead role, where a manager plays officially the role of a professional representing his organization in social activities and events.
- 2- The second role is leadership. This role is related to people's motivation and inspiration. As a leader, a manager must coach, support, and guide his/her subordinates.
- 3- The last role requested from a manager in the interpersonal cluster is to be a liaison and to build contacts with all stakeholders. Managers should oversee networking even beyond their organization boundary.

**B) Informational cluster includes also very critical roles. Based on these roles, the manager is supposed to communicate, monitor, manage, and distribute the information at all levels. Therefore, the detailed roles in this cluster are the following:**

- 4- Monitor: managers should ask for information inside and outside the workplace. This will help them to evaluate their department from internal and external viewpoints, discover related problems, and address them in due time.
- 5- Disseminator: managers must delegate more when it is appropriate and convey important information especially to their employees.
- 6- Spokesperson: as a manager one ought to transmit information outside the workplace taking the role of a brand ambassador.

### **C) Decisional part encompasses the following roles:**

- 7- Entrepreneur: behaving as an entrepreneur, managers should encourage change and creativity by leading the implementation of new ideas.
- 8- Disturbance-handler: managers are responsible for avoiding any disruptions that can prevent achieving the needed outcomes.
- 9- Resource-allocator: managers need to assign and administer a variety of financial, technological, and human resources activities.
- 10- Negotiator: surely a manager is responsible to carry out important negotiations within his department and organization.

- **Decision Making and Information Systems**
  - **Three main reasons why investments in information technology do not always produce positive results**
    - 1. Information quality**
      - High-quality decisions require high-quality information
    - 2. Management filters**
      - Managers have selective attention and have variety of biases that reject information that does not conform to prior conceptions
    - 3. Organizational inertia and politics**
      - Strong forces within organizations resist making decisions calling for major change

- Decision Making and Information Systems
  - **High velocity automated decision making**
    - Made possible through computer algorithms precisely defining steps for a highly structured decision
    - Humans taken out of decision
    - E.g. High-speed computer trading programs
      - Trades executed in 30 milliseconds
      - Responsible for “Flash Crash” of 2010
    - Require safeguards to ensure proper operation and regulation

- **Business Intelligence in the Enterprise**
  - **Business intelligence**
    - Infrastructure for collecting, storing, analyzing data produced by business
    - Databases, data warehouses, data marts.
  - **Business analytics**
    - Tools and techniques for analyzing data
    - OLAP, statistics, models, data mining.
  - **Business intelligence vendors**
    - Create business intelligence and analytics purchased by firms

- Business Intelligence in the Enterprise
  - Six elements in the business intelligence environment
    1. Data from the business environment
    2. Business intelligence infrastructure
    3. Business analytics toolset
    4. Managerial users and methods
    5. Delivery platform – MIS, DSS, ESS
    6. User interface



- Business Intelligence in the Enterprise

## BUSINESS INTELLIGENCE AND ANALYTICS FOR DECISION SUPPORT

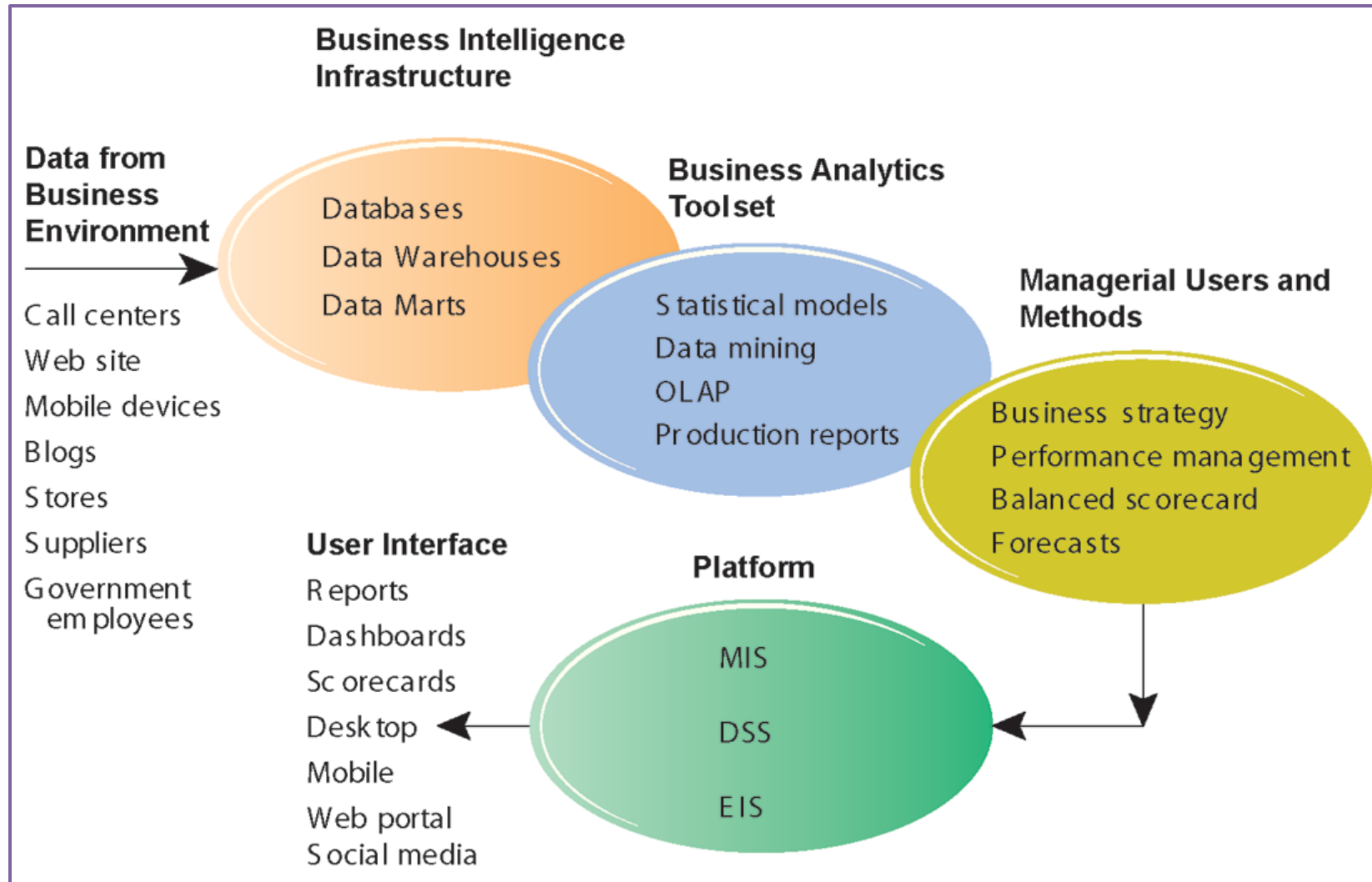


FIGURE 12-3

Business intelligence and analytics requires a strong database foundation, a set of analytic tools, and an involved management team that can ask intelligent questions and analyze data.

- **Information, decisions, and management**



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.

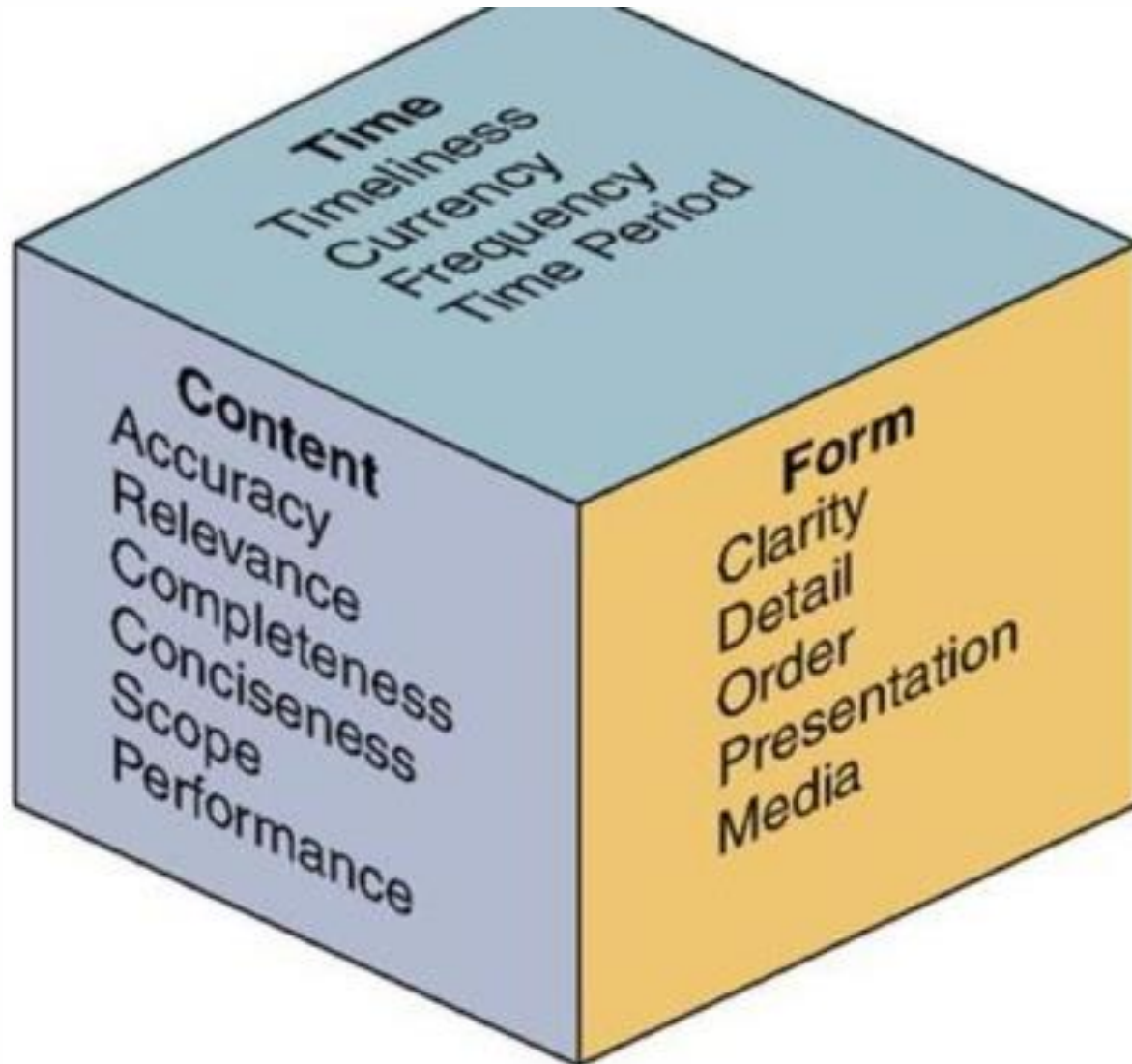
## **Operational Management:**

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.

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.

- **Information quality**





## **Time Dimension**

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

## **Content Dimension**

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

## **Form Dimension**

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

## Types of decisions:

- **Unstructured:** Decision maker must provide judgment, evaluation, and insight to solve problem
- **Structured:** Repetitive and routine; involve definite procedure for handling so they do not have to be treated each time as new
- **Semistructured:** Only part of problem has clear-cut answer provided by accepted procedure.

## Decision support systems:

- 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 pre specified internal reports emphasizing detailed current and historical data comparisons that support their more structured responsibilities in day-to-day operations.

# Decision Support Systems

An organized collection of people procedures, software, databases and devices used to help make decisions that solve problems are the decision support system (DSS). They deal with decision making effectiveness for unstructured and semi-structured business problems.

Benefits of DSS include:

- Generate higher profits
- Lower costs
- Better products and services

Sometimes these systems are used by all kinds of managers in government and non profit orgs as well.

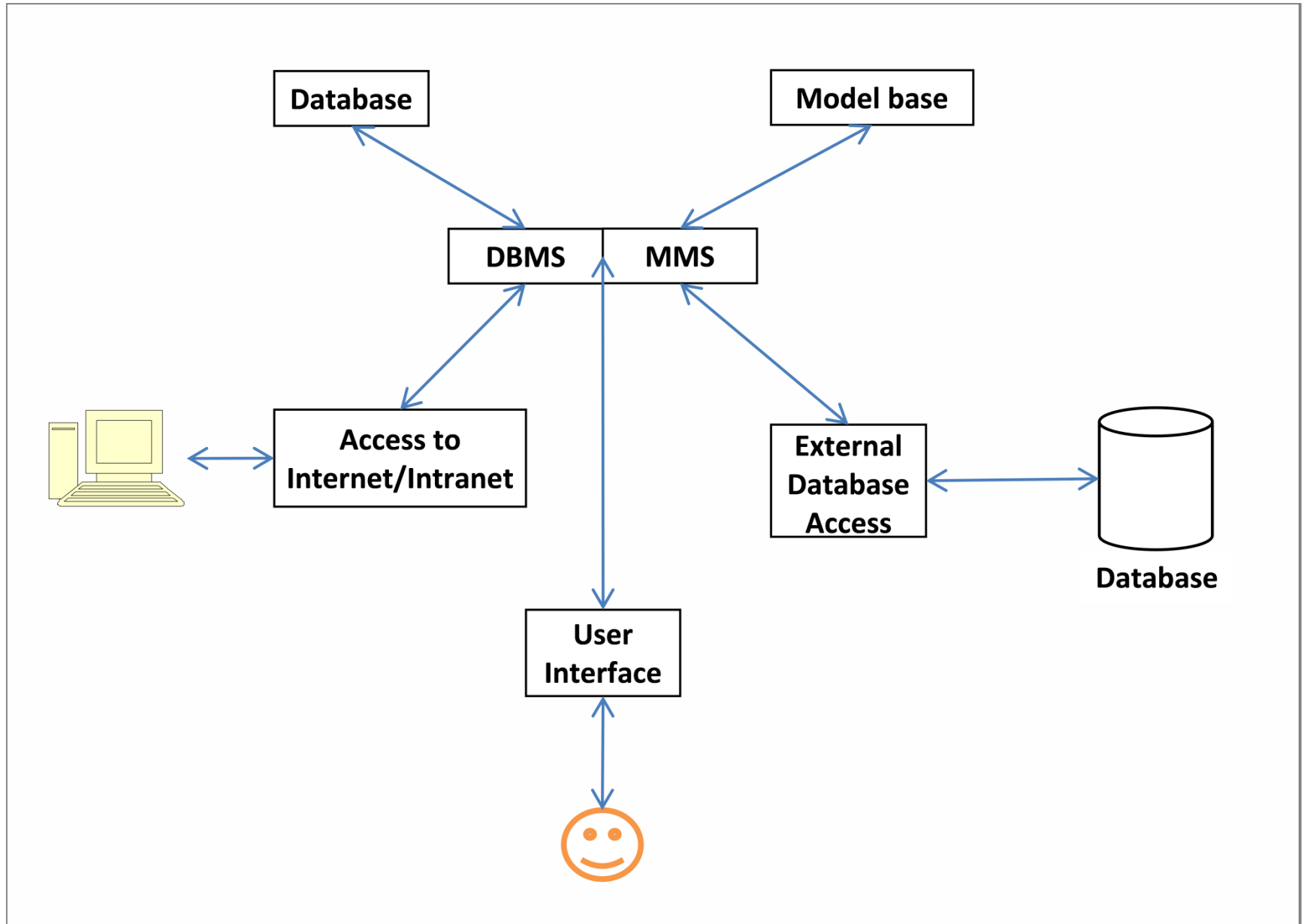
## **Characteristics of Decision Support System**

- Provide rapid access to information: information is received on the dashboard and the performance of the company can be seen in real-time. The dashboard show graphical and textual information.
- Handle large amounts of data from different sources: retrieve data from other databases over the network.
- Provide report and presentation flexibility: get the information in the format that suits the decision-maker.
- Textual and graphical representation: show text, tables, pie charts, trend lines or any preferred orientation.
- Support drill-down analysis: getting detailed information about a situation, e.g. cost of each phase, then activity, then task.
- Perform complex, sophisticated analysis and comparison:
- Support optimization, satisficing and heuristic approaches

# Capabilities of Decision Support System

- **Support for problem solving phases:** The problem solving phases include intelligence, design, choice and implementation. It gives decision maker flexibility in getting computer support for any one or a few phases.
- **Support for different decision frequencies:** Decisions can range from being the continuous once to something happening once in a while. Ad-hoc DSS handles 'one of a kind' decisions while institutional DSS handles repetitive decisions. E.g. computer related problems occur multiple times, a DSS can monitor the system and take action to prevent problem.
- **Support for different problem structures:** DSS supports decision from highly structured problems to semi structured and unstructured problems.
- **Support for various decision making levels:** Provide help to managers at different levels, which is operational, tactical and strategic decision making.

# Components of Decision Support System



## **The Database**

- DBMS allows managers and decision makers to perform qualitative analysis on the variety of data in the organization. So, a Data-driven DSS uses the company's databases, retrieving info on inventory, sales, personnel, production, accounts.
- E.g. Data-driven medical DSS allow doctors to have access to complete patient record.

## **The Model Base**

- A model base allows managers and decision makers to perform quantitative analysis. Model-driven DSS performs mathematical analysis by giving decision makers access to variety of models so that different scenarios can be explored.

## **The User Interface**

- The user interface allows users to interact with the background DSS. It is also called dialogue manager or dashboard.



## **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 non managerial individuals and self-directed teams of business professionals.
- Decision support in business is changing, driven by rapid developments in end-user computing and networking; Internet and Web technologies; and Web-enabled business applications.

## Online analytical processing:

- It supports **multidimensional data analysis**, so users can use **same data in different ways/dimensions** (product, pricing, region, time period) for better analysis. That's why they are used with data warehouses for storing and delivering warehouse information efficiently.
- It also enables users to obtain online answers to ad-hoc questions.
- It 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.
- OLAP systems are used to answer questions such as: how many washers sold in each of your sales regions and compare actual results with projected sales?

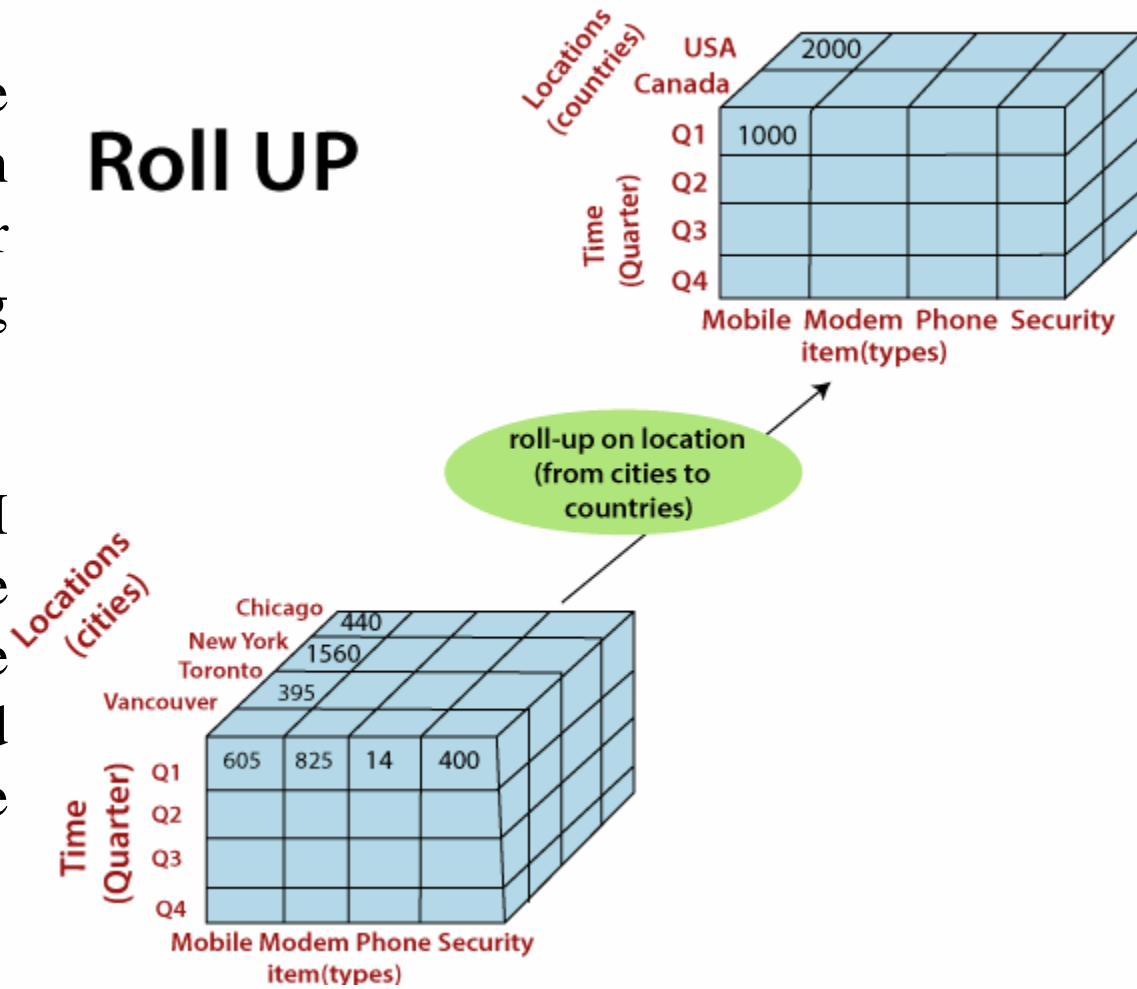
Online analytical processing involves several basic analytical operations, including consolidation “roll-up”, “drill-down,” and “slicing and dicing.”

## Consolidation “Roll-Up”:

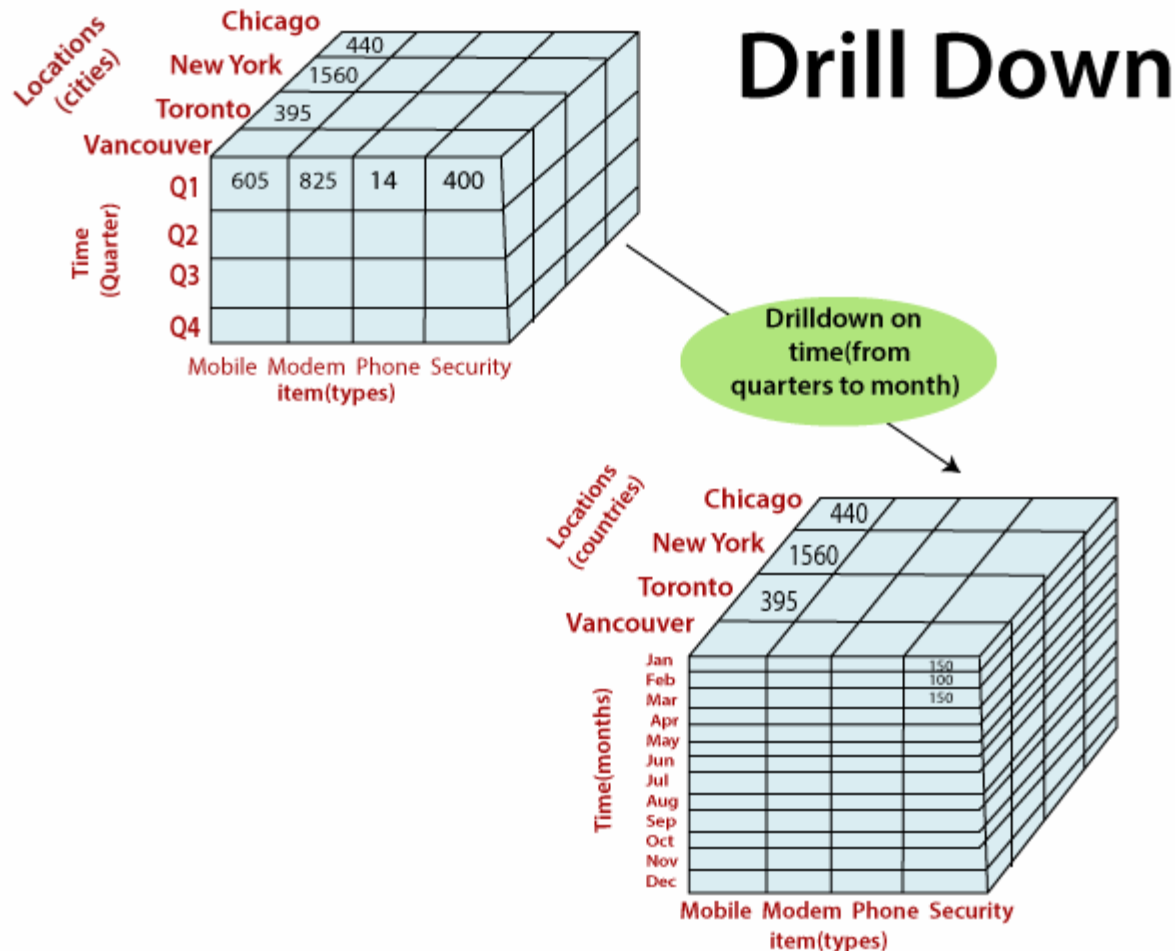
Consolidation involves the aggregation of data, which can involve simple roll-ups or complex groupings involving interrelated data.

For example, data about BIM can be rolled up to the Management faculty, and the management data can be rolled up to provide a College Perspective perspective

## Roll UP

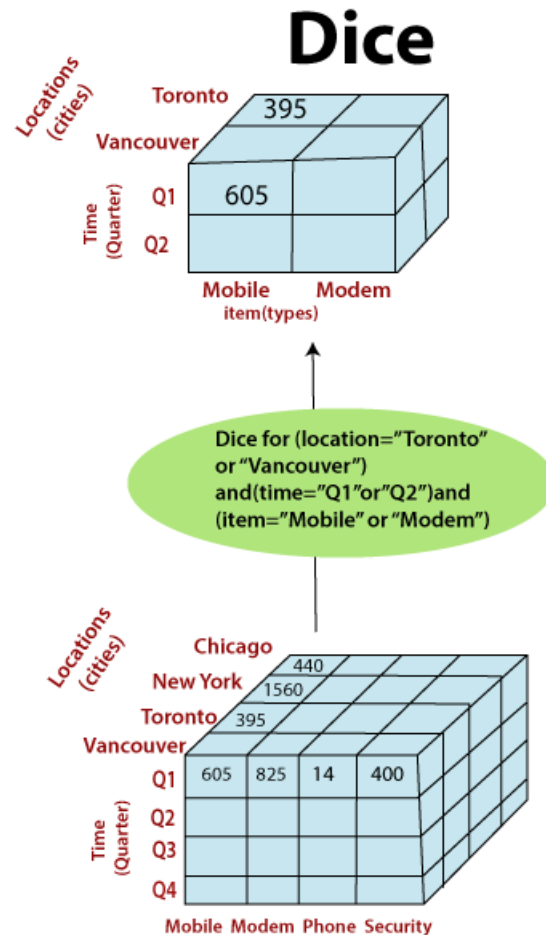
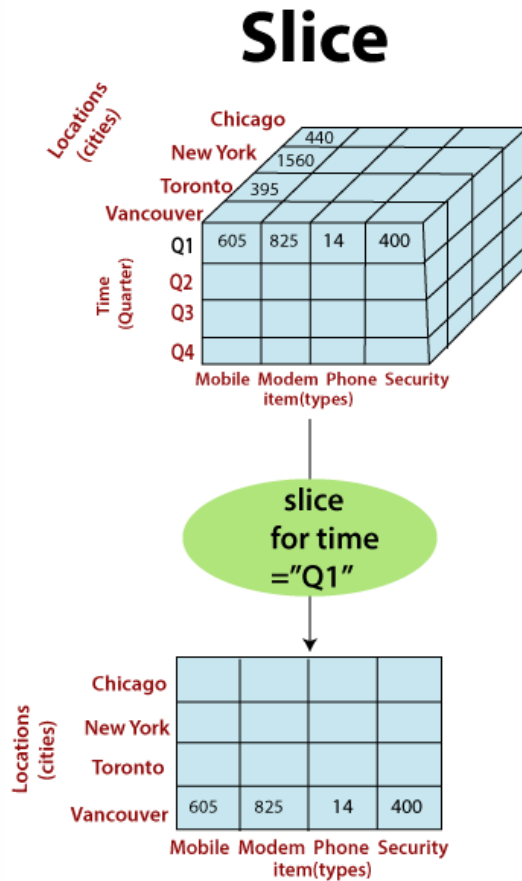


**Drill-down.** OLAP can also go in the reverse direction and automatically display detailed data that comprise consolidated data. This process is called drill-down. For example, the sales by individual products or sales reps in quarter can be further breakdown to month.



# Slicing and Dicing.

- Slicing and dicing refers to the ability to look at the database from different viewpoints. One slice of the sales database might show all sales of a product type within regions. Another slice might show all sales by sales channel within each product type. Slicing and dicing is often performed along a time axis to analyze trends and find time-based patterns in the data.



## **Slice**

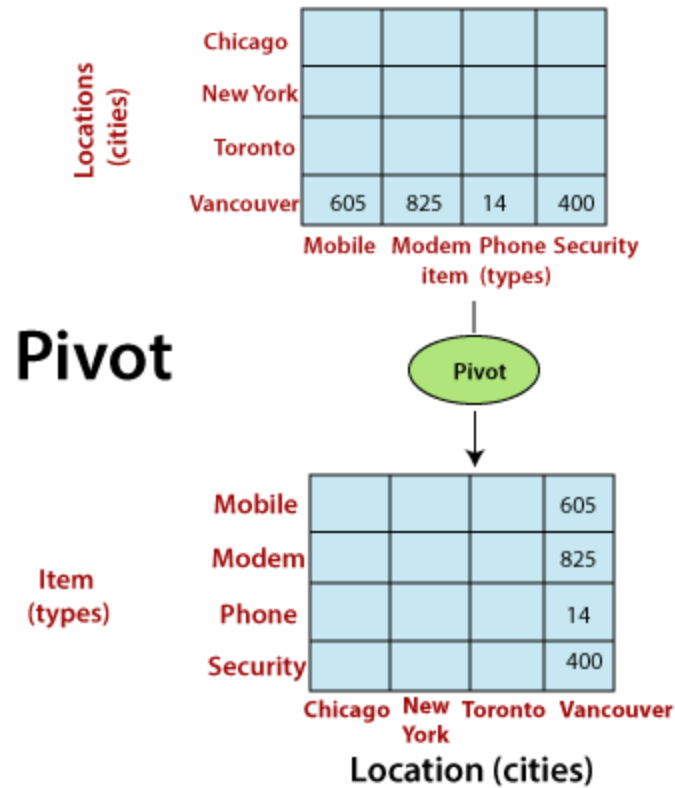
- The slice operation performs a selection on one dimension of the given cube, resulting in a subcube.
- Reduces the dimensionality of the cubes.

## **Dice**

- 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

**Pivot** is also known as rotate.

It rotates the data axis to view the data from different perspectives.



## **Common business areas where OLAP can solve**

- Complex problems include
- Marketing and sales analysis
- Clickstream data
- Database marketing
- Budgeting
- Financial reporting and consolidation
- Profitability analysis
- Quality analysis



## OLAP VS Data Mining

Online analytical processing interactively analyzes complex relationships among large amounts of data stored in multidimensional databases.

Data mining analyzes the vast amounts of historical data that have been prepared for analysis in data warehouses. Both technologies discover patterns, trends, and exception conditions in a company's data that support business analysis and decision making.

OLAP	Data Mining
Used for data analysis and decision making	Used for data analysis and decision making
Top-down, query driven analysis	Bottom up, discovery driven analysis
Users must be knowledgeable of data and its business context	Users trust in data mining tools to uncover valid hypotheses

## Using decision support systems:

A decision support system involves an **interactive analytical modeling process**.

This differs from the demand responses of management information systems because decision makers **are not demanding pre specified 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:

- What-if analysis,
- Sensitivity analysis,
- Goal-seeking analysis, and
- Optimization analysis

Type of Analytical Modeling	Activities and Examples
<b>What-if analysis</b>	<p>Observing how changes to selected variables affect other variables.  <i>Example:</i> What if we cut advertising by 10 percent? What would happen to sales?</p>
<b>Sensitivity analysis</b>	<p>Observing how repeated changes to a single variable affect other variables.  <i>Example:</i> Let's cut advertising by \$100 repeatedly so we can see its relationship to sales.</p>
<b>Goal-seeking analysis</b>	<p>Making repeated changes to selected variables until a chosen variable reaches a target value.  <i>Example:</i> Let's try increases in advertising until sales reach \$1 million.</p>
<b>Optimization analysis</b>	<p>Finding an optimum value for selected variables, given certain constraints.  <i>Example:</i> What's the best amount of advertising to have, given our budget and choice of media?</p>

## **What-if analysis**

User makes changes to variables, or relationships among variables, and observes the resulting changes in the values of other variables.

For example Change in tax rate will bring change to revenue of country but it also create changes in person saving.

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.

## **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.
- 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.

## **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.

## **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.

## 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.

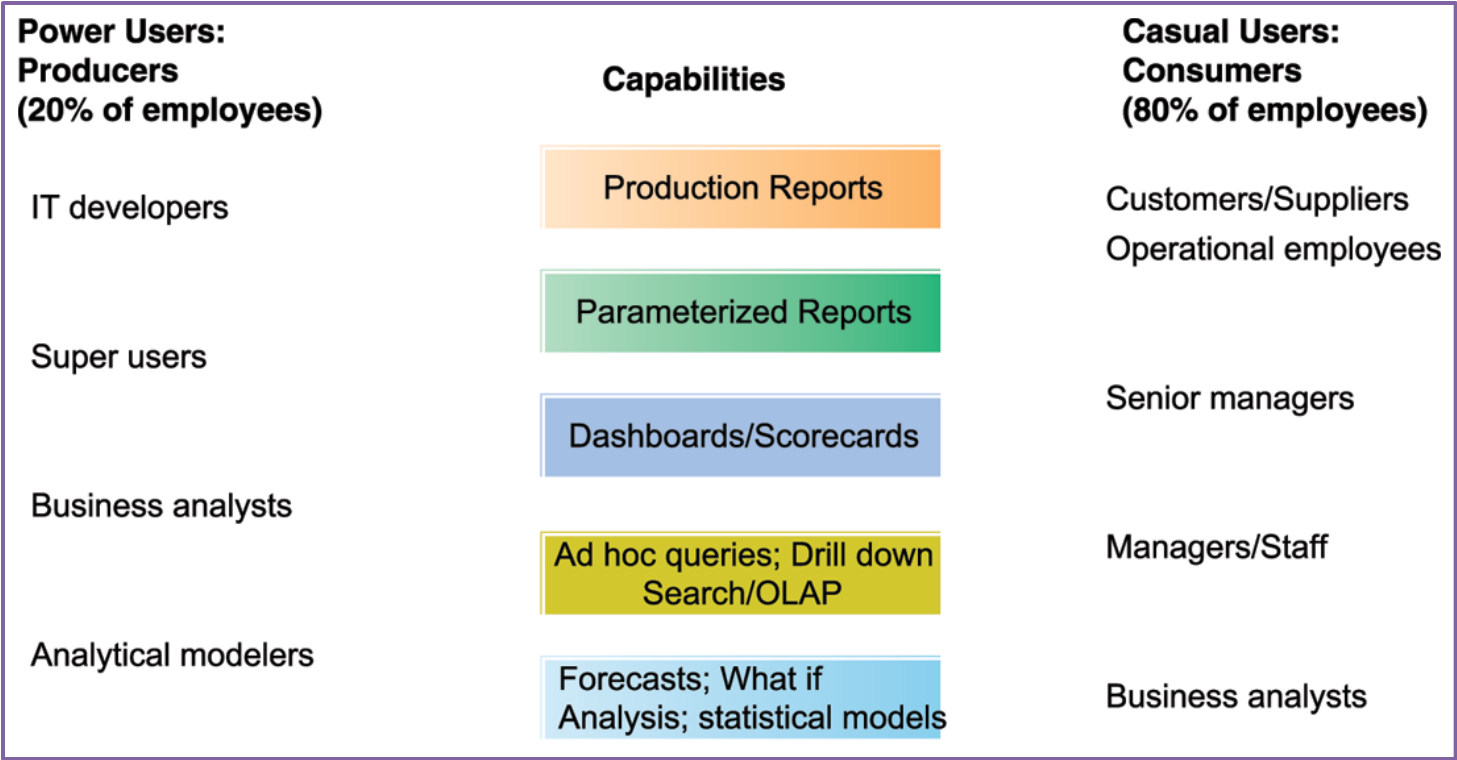


- Business Intelligence in the Enterprise
  - **Business intelligence and analytics capabilities**
    - **Goal is to deliver accurate real-time information to decision-makers**
    - **Main functionalities of BI systems**
      1. Production reports
      2. Parameterized reports
      3. Dashboards/scorecards
      4. Ad hoc query/search/report creation
      5. Drill down
      6. Forecasts, scenarios, models

- Business Intelligence in the Enterprise
  - **Business intelligence users**
    - **80% are casual users relying on production reports**
    - **Senior executives**
      - Use monitoring functionalities
    - **Middle managers and analysts**
      - Ad-hoc analysis
    - **Operational employees**
      - Prepackaged reports
      - E.g. sales forecasts, customer satisfaction, loyalty and attrition, supply chain backlog, employee productivity

- Business Intelligence in the Enterprise

**BUSINESS INTELLIGENCE USERS**



**FIGURE 12-4** Casual users are consumers of BI output, while intense power users are the producers of reports, new analyses, models, and forecasts.

- Business Intelligence in the Enterprise
  - **Examples of BI applications**
    - **Predictive analytics**
      - Use patterns in data to predict future behavior
      - E.g. Credit card companies use predictive analytics to determine customers at risk for leaving
    - **Data visualization**
      - Help users see patterns and relationships that would be difficult to see in text lists
    - **Geographic information systems (GIS)**
      - Ties location-related data to maps

- Business Intelligence in the Enterprise
- **Management strategies for developing BI and BA capabilities**
  - **Two main strategies**
    1. One-stop integrated solution
      - Hardware firms sell software that run optimally on their hardware
      - Makes firm dependent on single vendor – switching costs
    2. Multiple best-of-breed solution
      - Greater flexibility and independence
      - Potential difficulties in integration
      - Must deal with multiple vendors

- Business Intelligence in the Enterprise
- DATA-DRIVEN SCHOOLS

*Read the Interactive Session and discuss the following questions*

- **Identify and describe the problem discussed in the case.**
- **How do business intelligence systems provide a solution to this problem? What are the inputs and outputs of these systems?**
- **What management, organization, and technology issues must be addressed by this solution?**
- **How successful is this solution? Explain your answer.**
- **Should all school districts use such a data-driven approach to education? Why or why not?**

- Business Intelligence Constituencies
  - **Operational and middle managers**
    - Monitor day to day business performance
    - Make fairly structured decisions
    - Use MIS
  - **“Super user” and business analysts**
    - Use more sophisticated analysis
    - Create customized reports
    - Use DSS

- Business Intelligence Constituencies
- **Decision support systems**
  - **Use mathematical or analytical models**
  - **Allow varied types of analysis**
    - “What-if” analysis
    - Sensitivity analysis
    - Backward sensitivity analysis
    - Multidimensional analysis / OLAP
      - E. g. pivot tables



- Business Intelligence Constituencies

**SENSITIVITY ANALYSIS**

Total fixed costs	19000					
Variable cost per unit	3					
Average sales price	17					
Contribution margin	14					
Break-even point	1357					
		Variable Cost per Unit				
Sales	1357	2	3	4	5	6
Price	14	1583	1727	1900	2111	2375
	15	1462	1583	1727	1900	2111
	16	1357	1462	1583	1727	1900
	17	1267	1357	1462	1583	1727
	18	1188	1267	1357	1462	1583

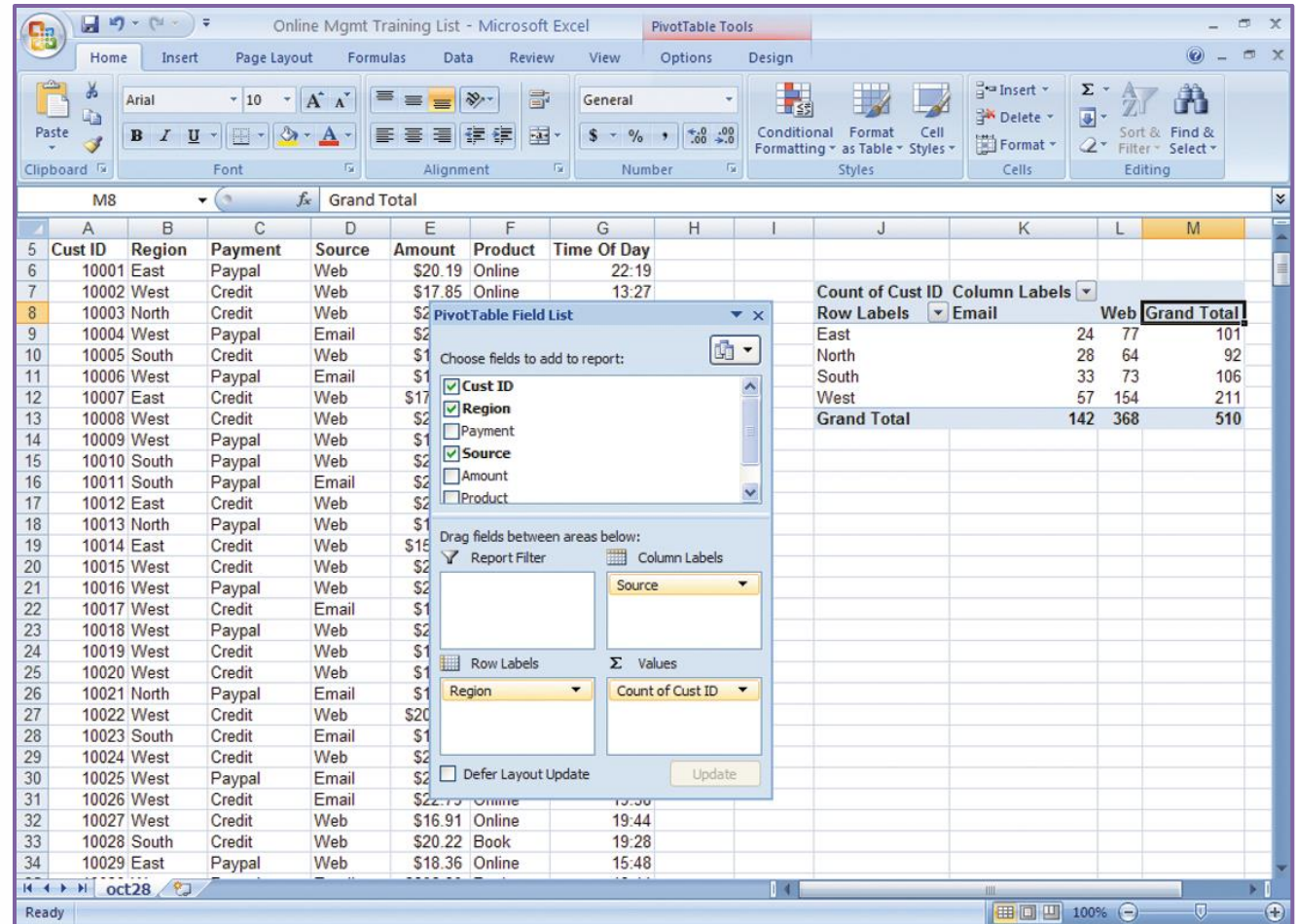
**FIGURE 12-5** This table displays the results of a sensitivity analysis of the effect of changing the sales price of a necktie and the cost per unit on the product’s break-even point. It answers the question, “What happens to the break-even point if the sales price and the cost to make each unit increases or decreases?”

# Business Intelligence Constituencies

## A PIVOT TABLE THAT EXAMINES CUSTOMER REGIONAL DISTRIBUTION AND ADVERTISING SOURCE

In this pivot table, we are able to examine where an online training company's customers come from in terms of region and advertising source.

FIGURE 12-6



- Business Intelligence Constituencies
  - **Decision-support for senior management**
    - **Help executives focus on important performance information**
    - **Balanced scorecard method:**
      - Measures outcomes on four dimensions:
        1. Financial
        2. Business process
        3. Customer
        4. Learning & growth
      - Key performance indicators (KPIs) measure each dimension

# Business Intelligence Constituencies

## THE BALANCED SCORECARD FRAMEWORK

In the balanced scorecard framework, the firm's strategic objectives are operationalized along four dimensions: financial, business process, customer, and learning and growth. Each dimension is measured using several KPIs.

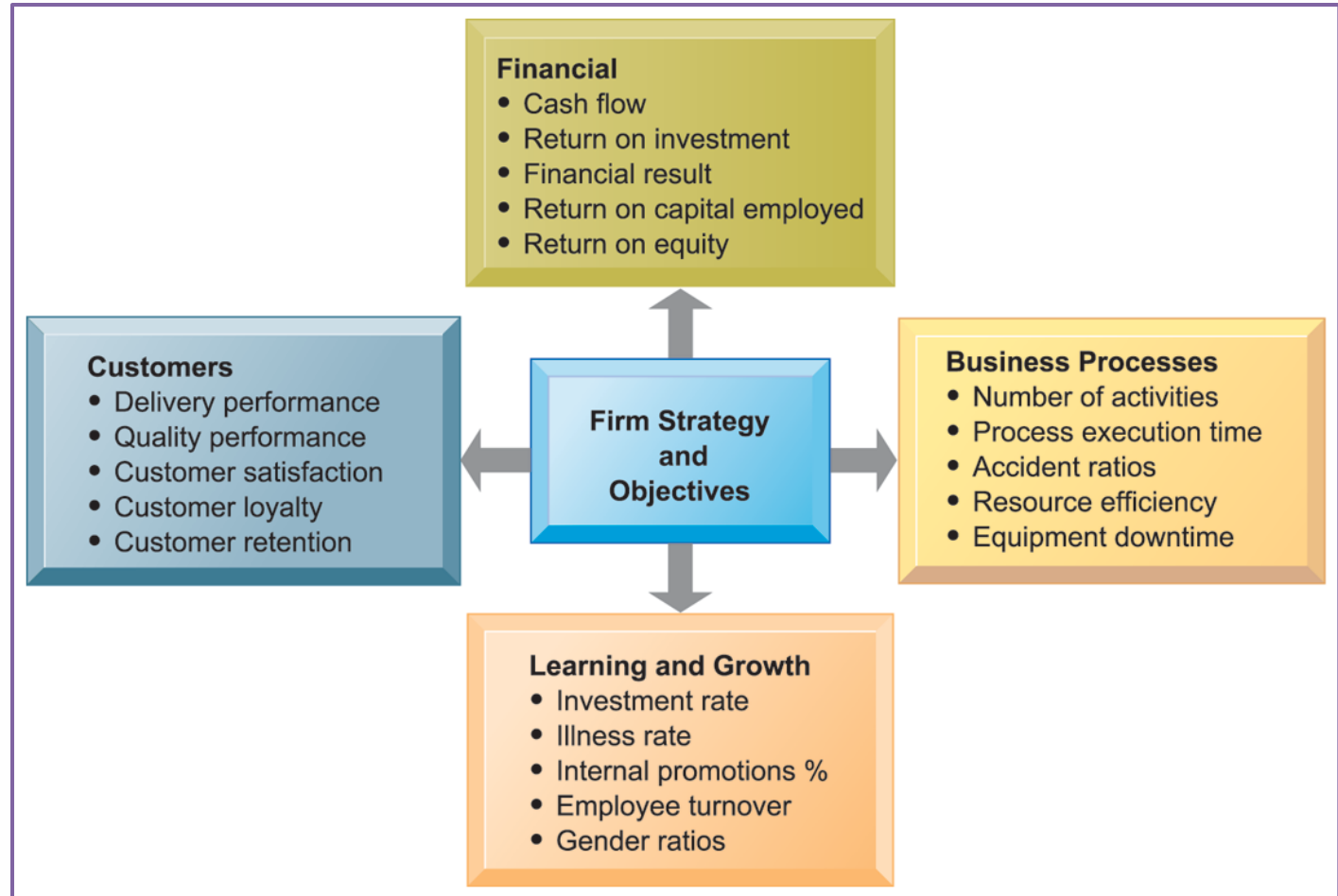


FIGURE 12-7

- Business Intelligence Constituencies
- **Decision-support for senior management (cont.)**
  - **Business performance management (BPM)**
    - Translates firm's strategies (e.g. differentiation, low-cost producer, scope of operation) into operational targets
    - KPIs developed to measure progress towards targets
  - **Data for ESS**
    - Internal data from enterprise applications
    - External data such as financial market databases
    - Drill-down capabilities

- Business Intelligence Constituencies
- PILOTING VALERO WITH REAL-TIME MANAGEMENT

*Read the Interactive Session and discuss the following questions*

- **What management, organization, and technology issues had to be addressed when developing Valero's dashboard?**
- **What measures of performance do the dashboards display? Give examples of several management decisions that would benefit from the information provided by Valero's dashboards.**
- **What kinds of information systems are required by Valero to maintain and operate its refining dashboard?**
- **How effective are Valero's dashboards in helping management pilot the company? Explain your answer.**
- **Should Valero develop a dashboard to measure the many factors in its environment that it does not control? Why or why not?**

- Business Intelligence Constituencies
- **Group Decision Support Systems (GDSS)**
  - **Interactive system to facilitate solution of unstructured problems by group**
  - **Specialized hardware and software; typically used in conference rooms**
    - Overhead projectors, display screens
    - Software to collect, rank, edit participant ideas and responses
    - May require facilitator and staff
  - **Enables increasing meeting size and increasing productivity**
  - **Promotes collaborative atmosphere, guaranteeing anonymity**
  - **Uses structured methods to organize and evaluate ideas**