Information & Decision Support Systems for Business and Application of Business Intelligence

Lecture-3 & 4
Managerial Decision Making

- Management is a **process** by which organizational goals are achieved by using resources
  - **Inputs**: resources
  - **Output**: attainment of goals
  - **Measure of success**: outputs / inputs

- Management ≡ Decision Making

- Decision making: selecting the best solution from two or more alternatives
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 Managerial behavior

Observers find that managerial behavior actually has five attributes that differ greatly from the classical description.

1. Managers perform a great deal of work at an unrelenting pace;
2. Managerial activities are fragmented;
3. Managers prefer current, specific, and ad hoc information;
4. Managers prefer oral forms of communication to written forms;
5. Managers give high priority to maintain a diverse and complex web of contacts that acts as an informal information system.
Mintzberg's 10 Managerial Roles

Interpersonal
1. Figurehead
2. Leader
3. Liaison

Informational
4. Monitor
5. Disseminator
6. Spokesperson

Decisional
7. Entrepreneur
8. Disturbance handler
9. Resource allocator
10. Negotiator
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
Perspectives on Information Systems

– Investing in information technology does not guarantee good returns
– Considerable variation in the returns firms receive from systems investments

Factors:
– Adopting the right business model
– Investing in complementary assets (organizational and management capital)
Complementary assets

- Assets required to derive value from a primary investment
- Firms supporting technology investments with investment in complementary assets receive superior returns

E.g.: invest in technology and the people to make it work properly
Decision making is difficult, because

- Technology, information systems, advanced search engines, and globalization result in more and more alternatives from which to choose.

- Government regulations and the need for compliance, political instability and terrorism, competition, and changing consumer demands produce more uncertainty, making it more difficult to predict consequences and the future.

- Other factors are the need to make rapid decisions, the frequent and unpredictable changes that make trial-and-error learning difficult, and the potential costs of making mistakes.
Why Use Computerized DSS

• Computerized DSS can facilitate decision via:
  • Speedy computations
  • Improved communication and collaboration
  • Increased productivity of group members
  • Improved data management
  • Overcoming cognitive limits
  • Quality support; agility support
  • Using Web; anywhere, anytime support
# A Decision Support Framework

(by Gory and Scott-Morten, 1971)

<table>
<thead>
<tr>
<th>Type of Decision</th>
<th>Operational Control</th>
<th>Managerial Control</th>
<th>Strategic Planning</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Structured</strong></td>
<td>Accounts receivable</td>
<td>Budget analysis</td>
<td>Financial management</td>
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<td>Accounts payable</td>
<td>Short-term forecasting</td>
<td>Investment portfolio</td>
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<td>Order entry</td>
<td>Personnel reports</td>
<td>Warehouse location</td>
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<td></td>
<td>Make-or-buy</td>
<td>Distribution systems</td>
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<tr>
<td><strong>Semistructured</strong></td>
<td>Production scheduling</td>
<td>Credit evaluation</td>
<td>Building a new plant</td>
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<td>Inventory control</td>
<td>Budget preparation</td>
<td>Mergers &amp; acquisitions</td>
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<td>Plant layout</td>
<td>New product planning</td>
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<td>Project scheduling</td>
<td>Compensation planning</td>
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<td>Reward scheduling</td>
<td>Quality assurance</td>
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<td>Reward system design</td>
<td>HR policies</td>
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<td>Inventory categorization</td>
<td>Inventory planning</td>
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<tr>
<td><strong>Unstructured</strong></td>
<td>Buying software</td>
<td>Negotiating</td>
<td>R &amp; D planning</td>
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<td>Approving loans</td>
<td>Recruiting an executive</td>
<td>New tech. development</td>
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<td>Operating a help desk</td>
<td>Buying hardware</td>
<td>Social responsibility planning</td>
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<td>Selecting a cover for a magazine</td>
<td>Lobbying</td>
<td>planning</td>
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</tbody>
</table>
A Decision Support Framework – cont.

Degree of Structuredness (Simon, 1977) Decision are classified as

- Highly structured (programmed)
- Semi-structured
- Highly unstructured (non-programmed)

Types of Control (Anthony, 1965)
- Strategic planning (top-level, long-range)
- Management control (tactical planning)
- Operational control
A Decision Support Framework – cont

• 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 Minneapolis?

• Operational managers, rank and file employees
  Make more structured decisions
  E.g. Does customer meet criteria for credit?
A Decision Support Framework – cont.

Decision Characteristics

- Unstructured
- Semistructured
- Structured

Examples of Decisions

- Decide entrance or exit from markets
- Approve capital budget
- Decide long-term goals
- Design a marketing plan
- Develop a departmental budget
- Design a new corporate Web site
- Determine overtime eligibility
- Restock inventory
- Offer credit to customers
- Determine special offers to customers

Senior Management

Middle Management

Operational Management
Individual Employees and Teams
Computer Support for Structured Decisions

• Structured problems: encountered repeatedly, have a high level of structure

• It is possible to abstract, analyze, and classify them into specific categories
  e.g., make-or-buy decisions, capital budgeting, resource allocation, distribution, procurement, and inventory control

• For each category a solution approach is developed => Management Science
Automated Decision Making

• A relatively new approach to supporting decision making
• Applies to highly structures decisions
• Automated decision systems (ADS) (or decision automation systems)
• An ADS is a rule-based system that provides a solution to a repetitive managerial problem in a specific area
  e.g., simple-loan approval system
• ADS initially appeared in the airline industry called revenue (or yield) management (or revenue optimization) systems
  - dynamically price tickets based on actual demand

• Today, many service industries use similar pricing models

• ADS are driven by business rules!
Automated Decision-Making Framework

Foundations and Sources:
- Technology
- DSS Theories
- Artificial Intelligence
- Business processes

Types:
- Customized
- Standard

Business decision rules
Automated decision-making system

Diagram showing the integration of various sources to automate decision-making.
DSS as an Umbrella Term

• The term DSS can be used as an umbrella term to describe any computerized system that supports decision making in an organization.

E.g., an organization wide knowledge management system; a decision support system specific to an organizational function (marketing, finance, accounting, manufacturing, planning, SCM, etc.)
High-Level Architecture of a DSS
Types of DSS

• Two major types:
  • Model-oriented DSS
  • Data-oriented DSS

• Evolution of DSS into Business Intelligence
  • Use of DSS moved from specialist to managers, and then whomever, whenever, wherever

• Enabling tools like OLAP, data warehousing, data mining, intelligent systems, delivered via Web technology have collectively led to the term “business intelligence” (BI) and “business analytics”
Business Intelligence (BI)

• BI is an umbrella term that combines architectures, tools, databases, analytical tools, applications, and methodologies.
• Like DSS, BI is a content-free expression, so it means different things to different people.
• BI's major objective is to enable easy access to data (and models) to provide business managers with the ability to conduct analysis.
• BI helps *transform* data, to information (and knowledge), to decisions and finally to action.
The Evolution of BI Capabilities

- Querying and reporting
- ETL
- Metadata
- Data warehouse
- Data marts
- EIS / ESS
- Financial reporting
- OLAP
- Digital cockpits and dashboards
- Scorecards and dashboards
- Workflow
- Alerts and notifications
- Data & text mining
- Predictive analytics
- Broadcasting tools
- Spreadsheets (MS Excel)
- DSS
- Portals
- Business Intelligence
The Architecture of BI

A BI system has four major components

- a data warehouse, with its source data
- business analytics, a collection of tools for manipulating, mining, and analyzing the data in the data warehouse;
- business performance management (BPM) for monitoring and analyzing performance
- a user interface (e.g., dashboard)
A High-Level Architecture of BI
Components in a BI Architecture

• The **data warehouse** is a large repository of well-organized historical data

• **Business analytics** are the tools that allow transformation of data into information and knowledge

• **Business performance management (BPM)** allows monitoring, measuring, and comparing key performance indicators

• **User interface** (e.g., dashboards) allows access and easy manipulation of other BI components
Styles of BI

- MicroStrategy, Corp. distinguishes five styles of BI and offers tools for each
  1. report delivery and alerting
  2. enterprise reporting (using dashboards and scorecards)
  3. cube analysis (also known as slice-and-dice analysis)
  4. ad-hoc queries
  5. statistics and data mining
The Benefits of BI

• The ability to provide accurate information when needed, including a real-time view of the corporate performance and its parts

• A survey by Thompson (2004)
  • Faster, more accurate reporting (81%)
  • Improved decision making (78%)
  • Improved customer service (56%)
  • Increased revenue (49%)
The DSS–BI Connection

• First, their architectures are very similar because BI evolved from DSS

• Second, DSS directly support specific decision making, while BI provides accurate and timely information, and indirectly support decision making

• Third, BI has an executive and strategy orientation, especially in its BPM and dashboard components, while DSS, in contrast, is oriented toward analysts
The DSS–BI Connection – cont.

• Fourth, most BI systems are constructed with commercially available tools and components, while DSS is often built from scratch.

• Fifth, DSS methodologies and even some tools were developed mostly in the academic world, while BI methodologies and tools were developed mostly by software companies.

• Sixth, many of the tools that BI uses are also considered DSS tools (e.g., data mining and predictive analysis are core tools in both).
Although some people equate DSS with BI, these systems are not, at present, the same

- some people believe that DSS is a part of BI—one of its analytical tools
- others think that BI is a special case of DSS that deals mostly with reporting, communication, and collaboration (a form of data-oriented DSS)
- BI is a result of a continuous revolution and, as such, DSS is one of BI's original elements

MSS = BI and/or DSS

- drop the word “systems” from DSS
- focus on “decision support”
  
  “use of any plausible computerized or non-computerized means for improving decision making in a particular repetitive or non-repetitive business situation in a particular organization”

- **Work system**: a system in which human participants and/or machines perform a business process, using information, technology, and other resources, to produce products and/or services for internal or external customers
Elements of a Work System

1. **Business process.** Variations in the process rationale, sequence of steps, or methods used for performing particular steps
2. **Participants.** Better training, better skills, higher levels of commitment, or better real-time or delayed feedback
3. **Information.** Better information quality, information availability, or information presentation
4. **Technology.** Better data storage and retrieval, models, algorithms, statistical or graphical capabilities, or computer interaction
Elements of a Work System – cont.

5. **Product and services.** Better ways to evaluate potential decisions
6. **Customers.** Better ways to involve customers in the decision process and to obtain greater clarity about their needs
7. **Infrastructure.** More effective use of shared infrastructure, which might lead to improvements
8. **Environment.** Better methods for incorporating concerns from the surrounding environment
9. **Strategy.** A fundamentally different operational strategy for the work system
# Major Tool Categories for MSS

<table>
<thead>
<tr>
<th>TOOL CATEGORY</th>
<th>TOOLS AND THEIR ACRONYMS</th>
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<tbody>
<tr>
<td>Data management</td>
<td>Databases and database management system (DBMS)</td>
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<td>Extraction, transformation, and load (ETL) systems</td>
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<td>Data warehouses (DW), real-time DW, and data marts</td>
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<td>Reporting status tracking</td>
<td>Online analytical processing (OLAP)</td>
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<td>Executive information systems (EIS)</td>
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<td>Visualization</td>
<td>Geographical information systems (GIS)</td>
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<td>Dashboards, Information portals</td>
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<td>Multidimensional presentations</td>
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<td>Business analytics</td>
<td>Optimization, Web analytics</td>
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<td>Data mining, Web mining, and text mining</td>
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<tr>
<td>Strategy and performance</td>
<td>Business performance management (BPM)/Corporate performance management (CPM)</td>
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<tr>
<td>management</td>
<td>Business activity management (BAM)</td>
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<td></td>
<td>Dashboards and Scorecards</td>
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<td>Communication and</td>
<td>Group decision support systems (GDSS)</td>
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<tr>
<td>collaboration</td>
<td>Group support systems (GSS)</td>
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<td></td>
<td>Collaborative information portals and systems</td>
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<tr>
<td>Social networking</td>
<td>Web 2.0, Expert locating systems</td>
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<tr>
<td>Knowledge management</td>
<td>Knowledge management systems (KMS)</td>
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<td>Intelligent systems</td>
<td>Expert systems (ES)</td>
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<td>Artificial neural networks (ANN)</td>
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<tr>
<td></td>
<td>Fuzzy logic, Genetic algorithms, Intelligent agents</td>
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<tr>
<td>Enterprise systems</td>
<td>Enterprise resource planning (ERP), Customer Relationship Management (CRM), and Supply-</td>
</tr>
<tr>
<td></td>
<td>Chain Management (SCM)</td>
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</tbody>
</table>
Hybrid (Integrated) Support Systems

• The objective of computerized decision support, regardless of its name or nature, is to assist management in solving managerial or organizational problems (and assess opportunities and strategies) faster and better than possible without computers.

• Every type of tool has certain capabilities and limitations. By integrating several tools, we can improve decision support because one tool can provide advantages where another is weak.

• The trend is therefore towards developing hybrid (integrated) support system.