DECISION SUPPORT SYSTEMS

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CENTRAL UNIVERSITY

FAITH • INTEGRITY • EXCELLENCE

Chapter 1

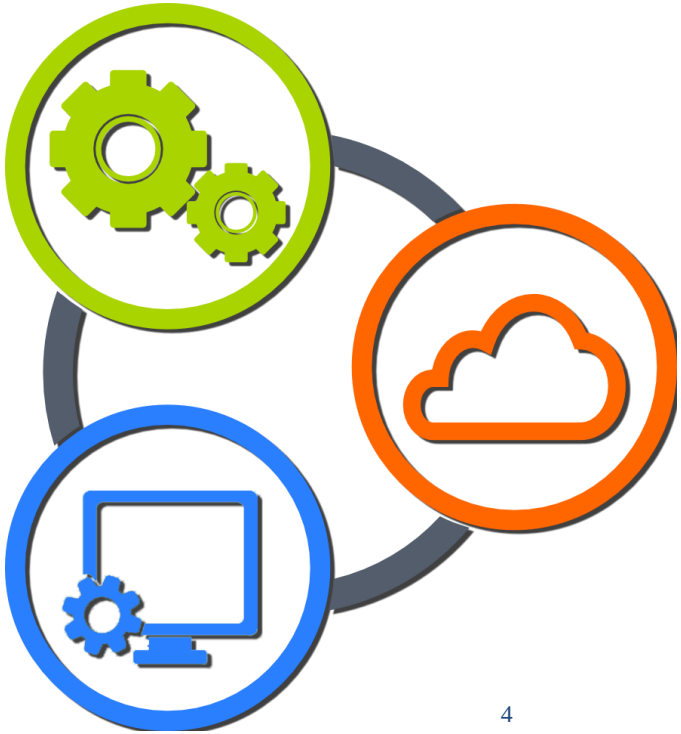
Learning Objectives

- Understand today's System and System property
- Understand the need for computerized support of managerial decision making
- Understand an early framework for managerial decision making
- Learn the conceptual foundations of the decision support systems (DSS) methodology

Systems

- What is a System?
  - a set of things working together as parts of a mechanism
  - an interconnecting network; a complex whole.

- *A system is "an orderly grouping of interdependent components linked together according to a plan to achieve a specific goal."*



Systems

Constraints of a System

- *A system must have some **structure and behavior** which is designed to achieve a predefined objective.*
- ***Interconnectivity** and **interdependence** must exist among the system components.*
- *The **objectives of the organization** have a **higher priority** than the objectives of its subsystems.*

- For example, traffic management system, payroll system, automatic library system, human resources information system.

System Properties

- A system has the following properties −
- Organization - implies structure and order.
- It is the arrangement of components that helps to achieve predetermined objectives.

❑ Interaction - It is defined by the manner in which the components operate with each other.

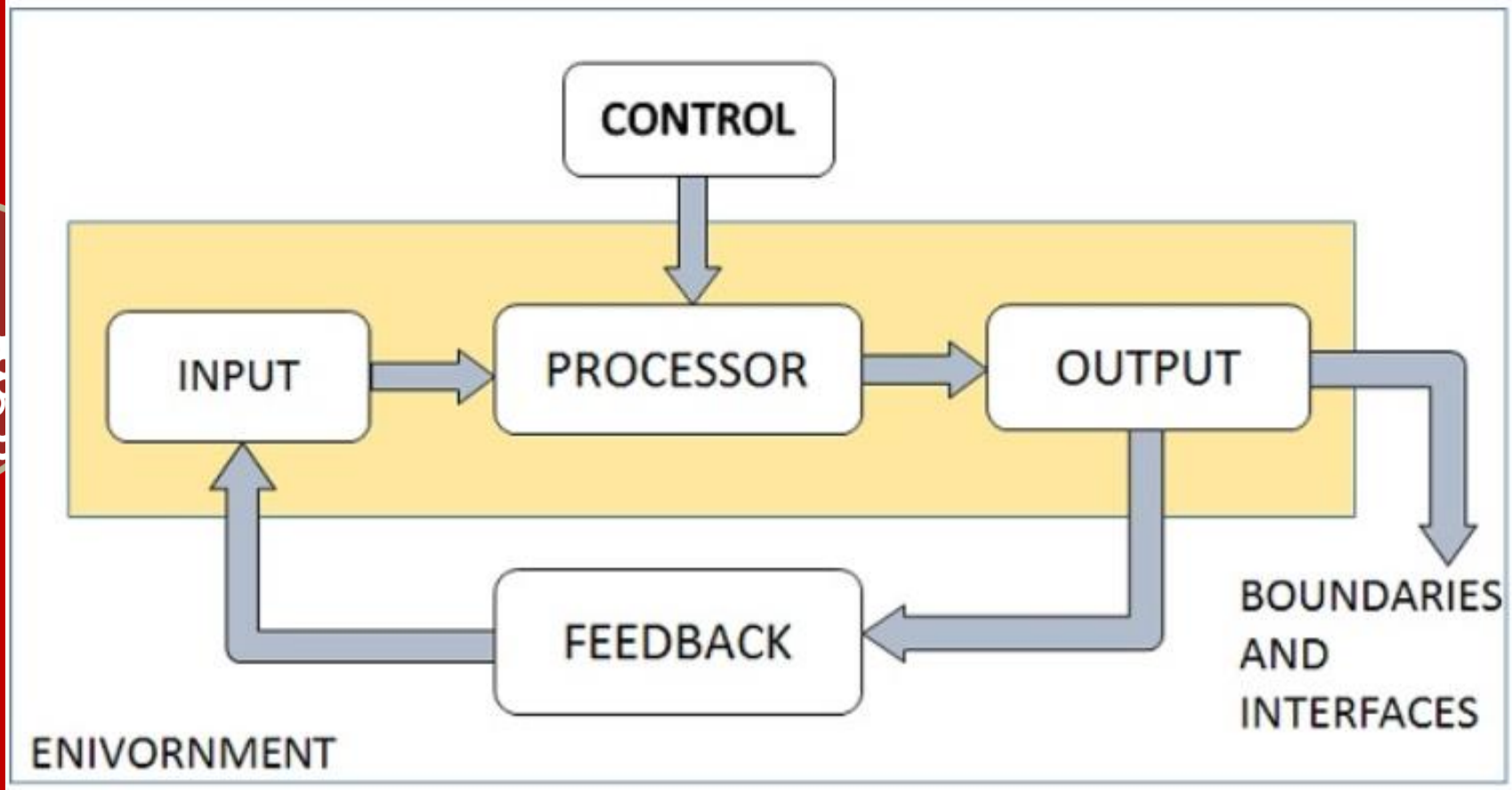
- For example, in an organization, purchasing department must interact with production department and payroll with personnel department.

❑ Interdependence - means how the components of a system depend on one another.

- For proper functioning, the components are coordinated and linked together according to a specified plan. The output of one subsystem is the required by other subsystem as input.
- Integration - is concerned with how a system components are connected together.
- It means that the parts of the system work together within the system even if each part performs a unique function.

System Elements

- Elements of a System
- The following diagram shows the elements of a system −



Element of a Systems

Outputs and Inputs

- *The main aim of a system is to produce an output which is useful for its user.*
- *Inputs are the information that enters into the system for processing.*
- *Output is the outcome of processing.*

Processor(s)

- *The processor is the element of a system that involves the actual transformation of input into output.*
- *It is the operational component of a system. Processors may modify the input either totally or partially, depending on the output specification.*
- *As the output specifications change, so does the processing. In some cases, input is also modified to enable the processor for handling the transformation.*

Control

- *The control element guides the system.*
- *It is the decision–making subsystem that controls the pattern of activities governing input, processing, and output.*
- *The behavior of a computer System is controlled by the Operating System and software. In order to keep system in balance, what and how much input is needed is determined by Output Specifications.*

- **Feedback**
  - *Feedback provides the control in a dynamic system.*
  - *Positive feedback is routine in nature that encourages the performance of the system.*
  - *Negative feedback is informational in nature that provides the controller with information for action.*

❑Environment

- *The environment is the "supersystem" within which an organization operates.*
- *It is the source of external elements that strike on the system.*
- *It determines how a system must function. For example, vendors and competitors of organization's environment, may provide constraints that affect the actual performance of the business.*

❑Boundaries and Interface

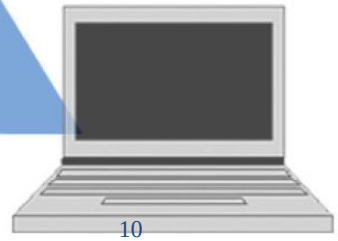
- *A system should be defined by its boundaries. Boundaries are the limits that identify its components, processes, and interrelationship when it interfaces with another system.*
- *Each system has boundaries that determine its sphere of influence and control.*
- *The knowledge of the boundaries of a given system is crucial in determining the nature of its interface with other systems for successful design.*

Information Systems

People
The actors who interact in a business process

Business Processes
Goal-oriented activities conducted by a business

Information Technology
Hardware/software used to facilitate business activities

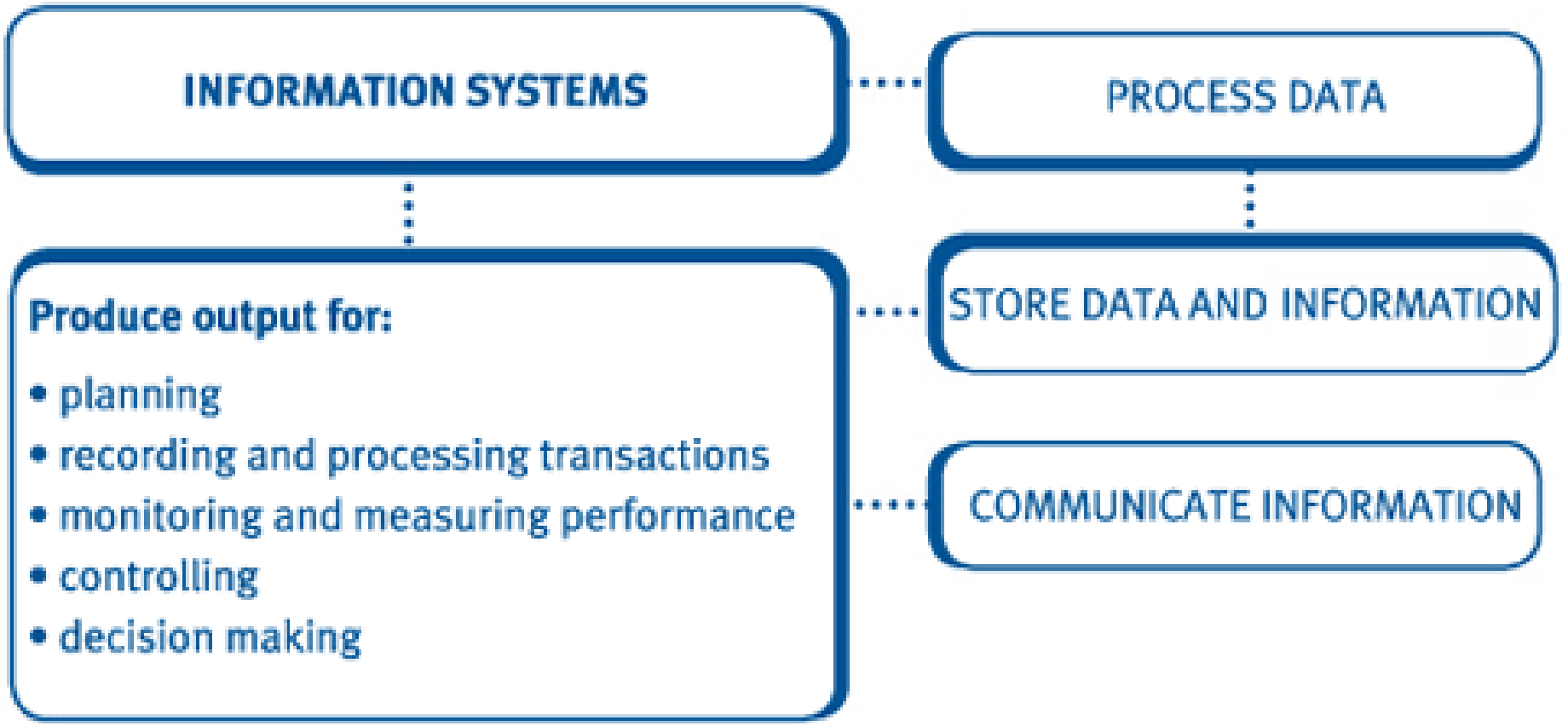


Information Systems

- IS can be any organised combination of people, hardware, software, communication network and data resources that collect, transform and disseminate information in an organisation.

- Some IS use single manual (paper and pencil) communication channels and others use a computer based information systems that use computer hardware and software, the internet and other telecommunication networks, computer based resources, managerial technique and many other information technologies to transform data into an endless variety of information product for consumers and business professional.

Information Systems



Categories of Information

Volume of Information	Type of Information	Information Level	Management Level	System Support
Low Consensed	Unstructured	Strategic Information	Upper	DSS
Medium Moderately Processed	Moderately Structured	Management Control Information	Middle	MIS
Large Detail Reports	Highly Structured	Operational Information	Lower	DPS

Strategic Information

- *This information is required by topmost management for long range planning policies for next few years. For example, trends in revenues, financial investment, and human resources, and population growth.*
- *This type of information is achieved with the aid of Decision Support System (DSS).*

Managerial Information

- *This type of Information is required by middle management for short and intermediate range planning which is in terms of months. For example, sales analysis, cash flow projection, and annual financial statements.*
- *It is achieved with the aid of Management Information Systems (MIS).*

Operational information

- *This type of information is required by low management for daily and short term planning to enforce day-to-day operational activities. For example, keeping employee attendance records, overdue purchase orders, and current stocks available.*
- *It is achieved with the aid of Data Processing Systems (DPS).*

Where Do Information Systems Project Come From?

- **Problem** – an undesirable situation that prevents the organization from fully achieving its purpose, goals, and/or objectives.
- **Opportunity** – a chance to improve the organization even in the absence of an identified problem.
- **Directive** - a new requirement that is imposed by management, government, or some external influence.

Managerial Decision Making

- The nature of managers' work
  - *Interpersonal*
  - *Informational*
  - *Decisional*

Managerial Decision Making

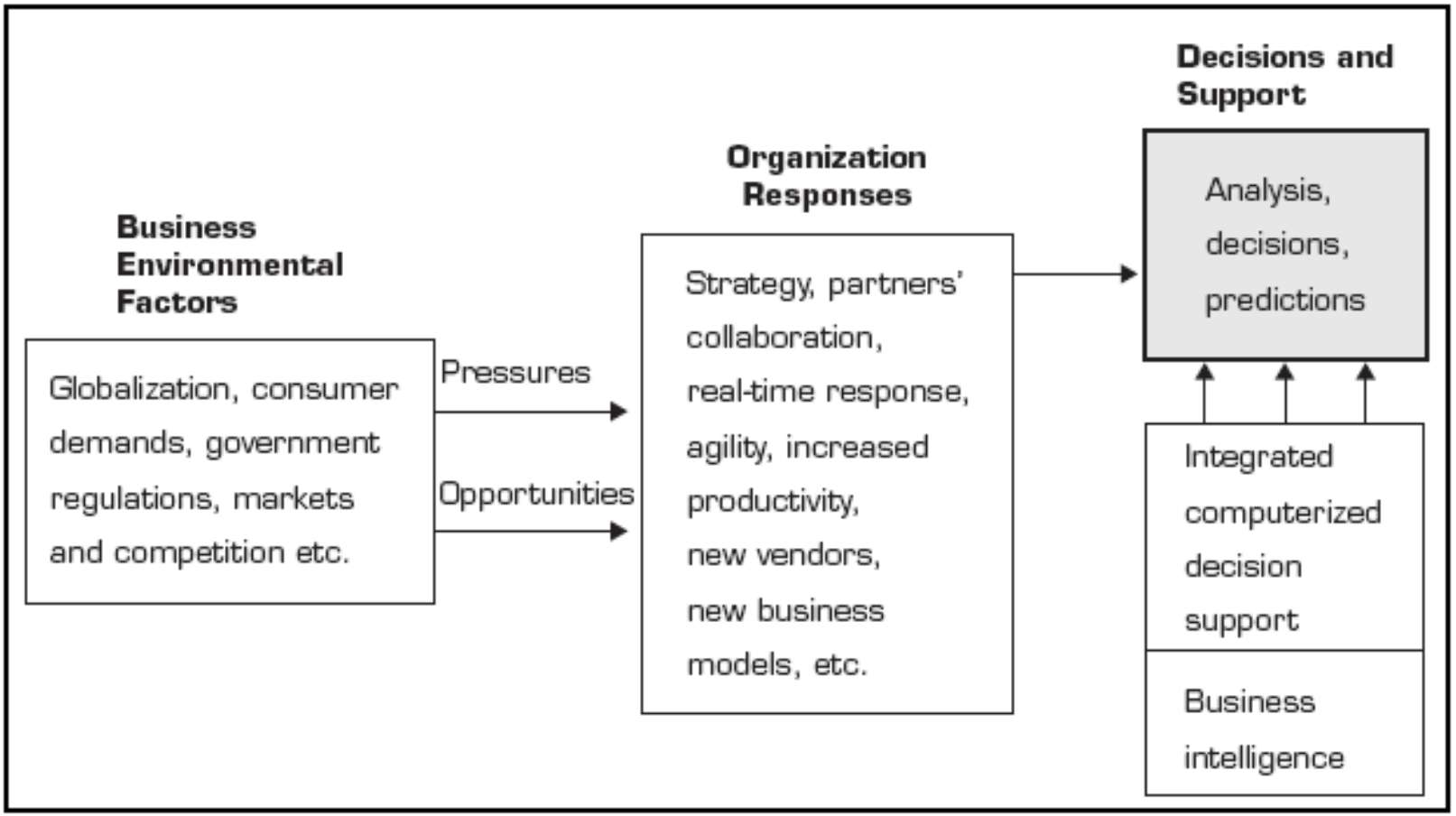


FIGURE 1.1 The Business Pressures–Responses–Support Model

Managerial Decision Making

The process of decision making

1. *Defining the problem (a decision situation that may deal with some difficulty or with an opportunity)*
2. *Constructing a model that describes the real-world problem*
3. *Identifying possible solutions to the modeled problem and evaluating the solutions*
4. *Comparing, choosing, and recommending a potential solution to the problem*

Managerial Decision Making

- **Decision support systems (DSS)**

  A conceptual framework for a process of supporting managerial decision- making, usually by modeling problems and employing quantitative models for solution analysis

DSS are interactive software-based systems intended to help managers in decision-making by accessing large volumes of information generated from various **related information systems** involved in organizational business processes, such as office automation system, transaction processing system, etc.

Decision support systems (DSS)

- DSS uses the summary information, exceptions, patterns, and trends using the analytical models.
- A decision support system helps in decision-making but does not necessarily give a decision itself.
- The decision makers compile useful information from raw data, documents, personal knowledge, and/or business models to identify and solve problems and make decisions.

DSS – Types of Decision

Programmed and Non-programmed Decisions

- There are two types of decisions

❑Programmed decisions are basically automated processes, general routine work, where −

- ❑These decisions have been taken several times.
- ❑These decisions follow some guidelines or rules.

- For example, selecting a reorder level for inventories, is a programmed decision.

DSS – Types of Decision

Non-programmed decisions occur in unusual and non-addressed situations, so −

- It would be a new decision.
- There will not be any rules to follow.
- These decisions are made based on the available information.
- These decisions are based on the manger's discretion, instinct, perception and judgment.

- For example, investing in a new technology is a non-programmed decision.
- Decision support systems generally involve non-programmed decisions. Therefore, there will be no exact report, content, or format for these systems. Reports are generated on the fly.

Computerized Support for Decision Making

- Why use computerized decision support systems
  - *Speedy computations*
  - *Improved communication and collaboration*
  - *Increased productivity of group members*
  - *Improved data management*
  - *Managing giant data warehouses*

Computerized Support for Decision Making

- Attributes of a DSS
  - Adaptability and flexibility
  - High level of Interactivity
  - Ease of use
  - Efficiency and effectiveness
  - Complete control by decision-makers
  - Ease of development
  - Extendibility
  - Support for modeling and analysis
  - Support for data access
  - Standalone, integrated, and Web-based

Computerized Support for Decision Making

- Why use computerized decision support systems
  - *Quality support*
  - *Agility support*
  - *Overcoming cognitive limits in processing and storing information*
    - The limitations of the human mind related to processing information
  - *Using the Web*
  - *Anywhere, anytime support*

An Early Framework for Computerized Decision Support

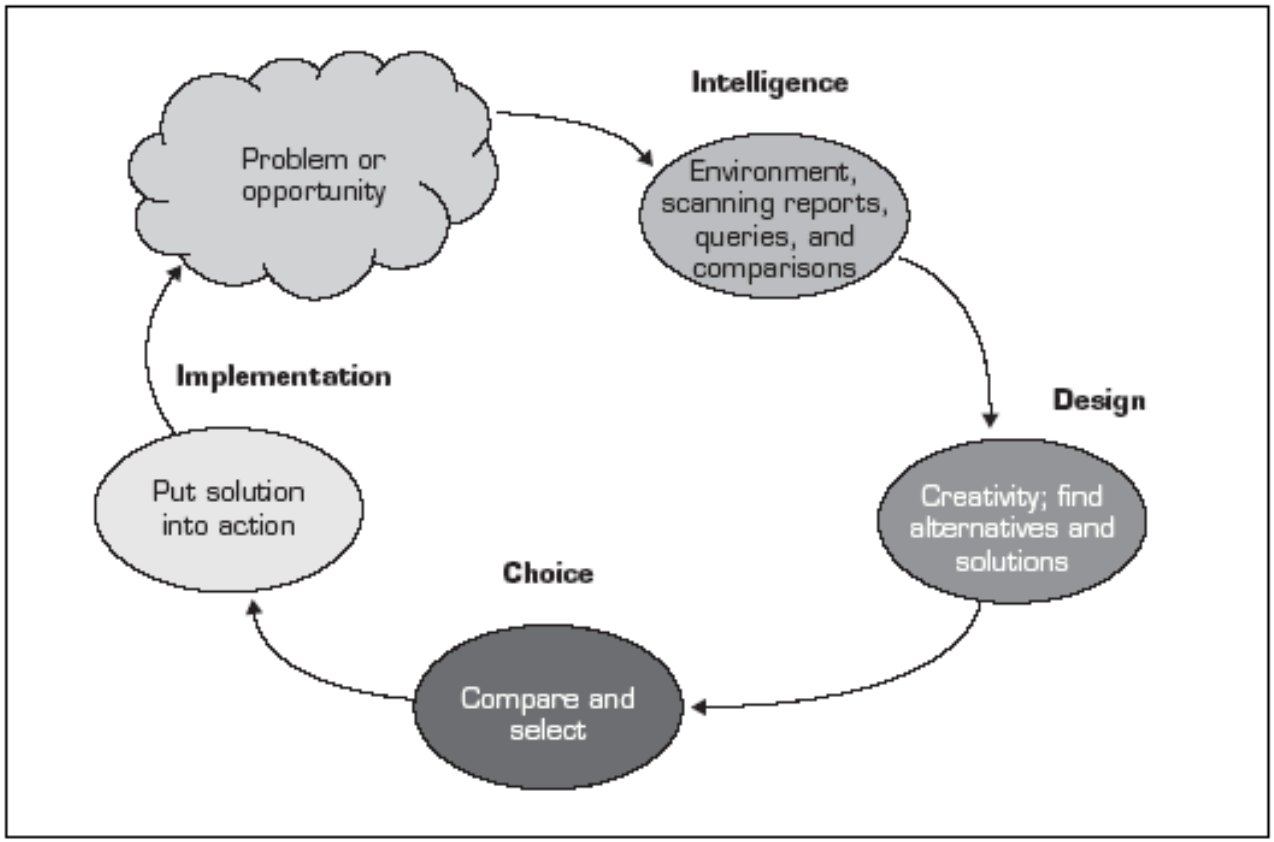
FIGURE 1.2 Decision Support Frameworks

Type of Decision	Type of Control: Operational Control	Type of Control: Managerial Control	Type of Control: Strategic Planning
Structured	1 Accounts receivable, accounts payable, order entry	2 Budget analysis, short-term forecasting, personnel reports, make-or-buy	3 Financial management (investment), warehouse location, distribution systems
Semistructured	4 Production scheduling, inventory control	5 Credit evaluation, budget preparation, plant layout, project scheduling, reward system design, inventory categorization	6 Building new plant, mergers and acquisitions, new product planning, compensation planning, quality assurance planning, HR policies, inventory planning
Unstructured	7 Selecting a cover for a magazine, buying software, approving loans, help desk	8 Negotiating, recruiting an executive, buying hardware, lobbying	9 R & D planning, new technology development, social responsibility planning

An Early Framework for Computerized Decision Support

- ***Degree of structuredness***
  - Four-phase decision making process
    - ***Intelligence, Design, Choice, Implementation***

FIGURE 1.3 The Steps of Decision Support



An Early Framework for Computerized Decision Support

- *Types of control in all managerial activities*
  - Strategic planning
  - Management control
  - Operational control
- *The decision support matrix*
  - For *semistructured decisions* and *unstructured decisions*, conventional MIS and *MS* tools are insufficient
  - Decision support systems (DSS) are used

An Early Framework for Computerized Decision Support

- Computer support for structured decisions
  - ***Management science (MS)*** *or* ***operations research (OR)***

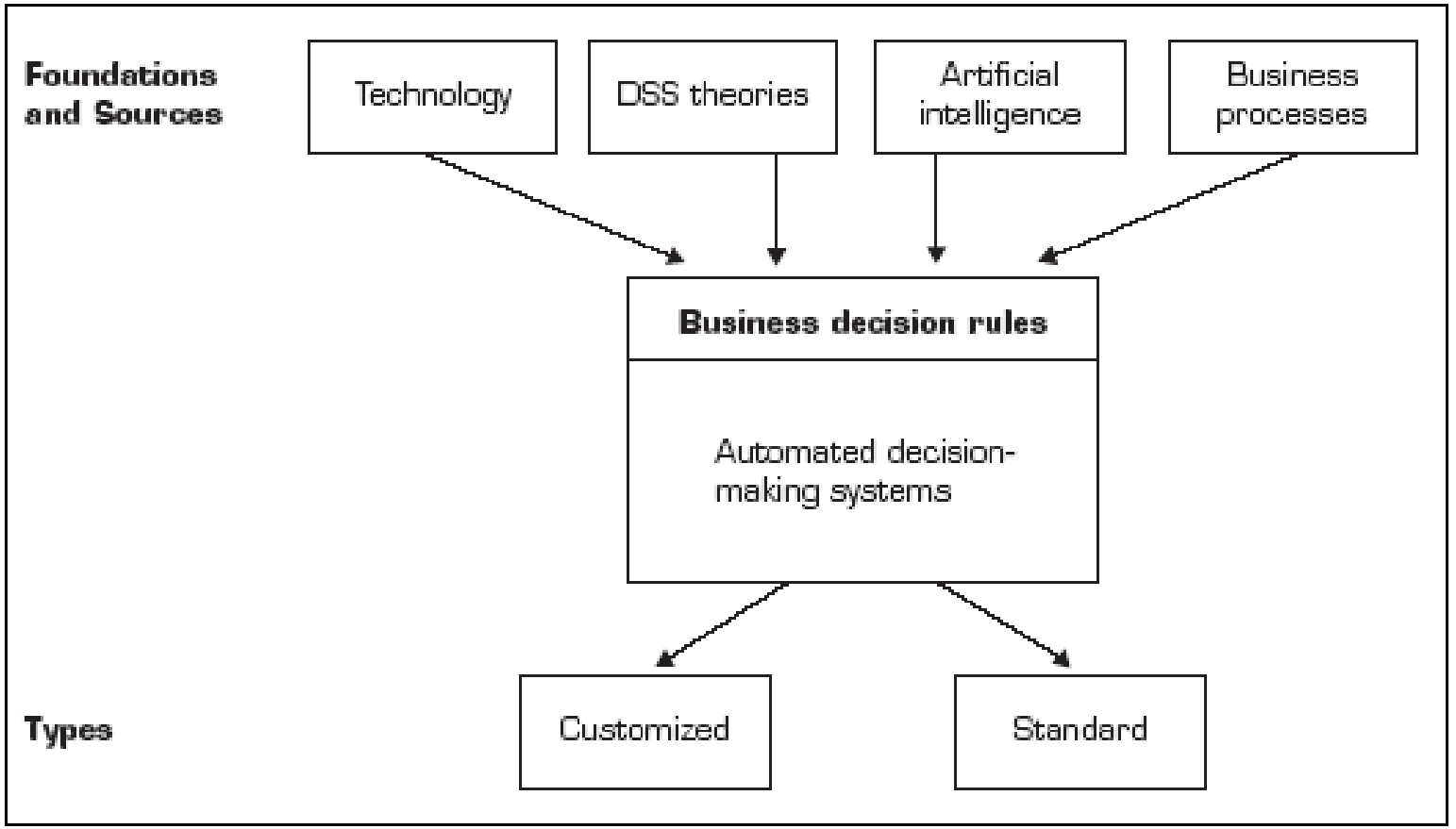
    The application of a scientific approach and mathematical models to the analysis and solution of managerial decision situations (e.g., problems, opportunities)

  - ***Automated decision systems (ADS)***

    A business rules-based system that uses intelligence to recommend solutions to repetitive decisions (such as pricing)

An Early Framework for Computerized Decision Support

FIGURE 1.4 Automated Decision-Making Framework



An Early Framework for Computerized Decision Support

- Computer support for unstructured decisions
  - *Customized solutions*
  - *intuition and judgment*
  - *Computerized communication and collaboration technologies*
  - *Knowledge management*
- Computer support for semistructured problems
  - *A combination of both standard solution procedures and human judgment*
  - *Management Science can provide models for the structured portion*
  - *For the unstructured portion, a DSS can improve the quality of the information on which the decision is based by providing a range of alternative solutions along with their potential impacts*

An Early Framework for Computerized Decision Support

- The benefits of computerized decision support
  - *Companies work in an unstable or rapidly changing economy.*
  - *There are difficulties in tracking the numerous business operations.*
  - *Competition has increased especially global competition.*
  - *Electronic commerce is changing the ways business is done.*
  - *Existing information systems do not fully support decision making.*
  - *The Information systems department is too busy to address all of management's inquiries.*
  - *Special analysis of profitability and efficiency is needed.*
  - *Accurate information is needed.*
  - *Computerized support is viewed as an organizational winner.*
  - *New information is needed.*

An Early Framework for Computerized Decision Support

- The benefits of computerized decision support
  - *Management mandates computerized decision support.*
  - *Higher decision quality is needed.*
  - *Improved communication.*
  - *Improved customer and employee satisfaction.*
  - *Timely information is provided.*
  - *Cost reduction is achieved.*
  - *Employees' productivity has been improved.*

Benefits of DSS

- Improves efficiency and speed of decision-making activities.
- Increases the control, competitiveness and capability of futuristic decision-making of the organization.
- Facilitates interpersonal communication.
- Encourages learning or training.
- Since it is mostly used in non-programmed decisions, it reveals new approaches and sets up new evidences for an unusual decision.
- Helps automate managerial processes.

Characteristics of DSS

- Support for decision-makers in semi-structured and unstructured problems.
- Support for managers at various managerial levels, ranging from top executive to line managers.
- Support for individuals and groups. Less structured problems often requires the involvement of several individuals from different departments and organization level.
- Support for interdependent or sequential decisions.
- Support for intelligence, design, choice, and implementation.
- Support for variety of decision processes and styles.
- DSSs are adaptive over time

The Concept of DSS

- DSS as an Umbrella term: Describes any computerized system that supports decision making in an organization
  - *DSS as a specific application*
  - *The architecture of DSS*
    - Data
    - Models manipulate data as related to a specific situation
    - Knowledge component
    - Users
    - User interface

The Concept of Decision Support Systems (DSS)

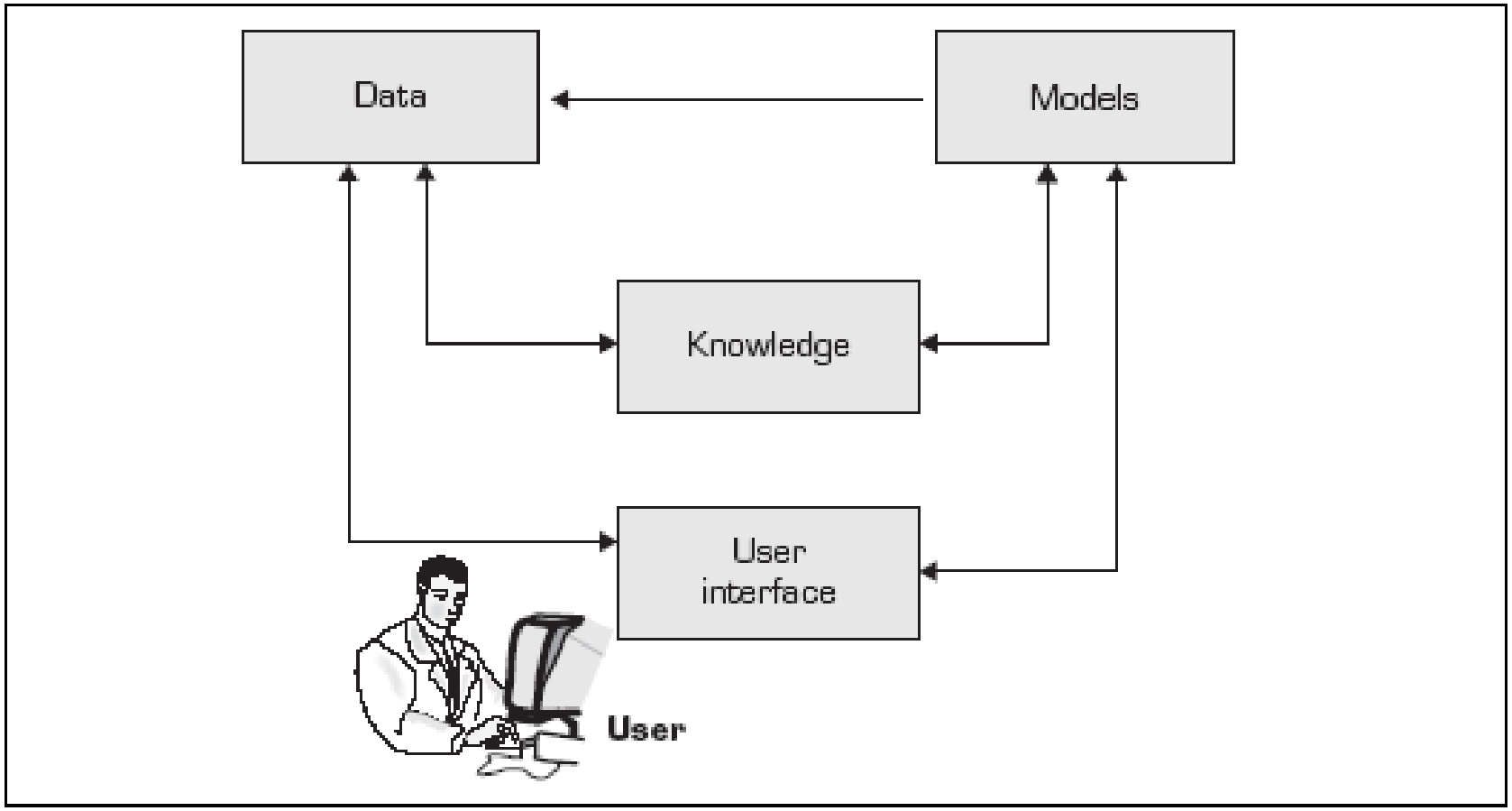


FIGURE 1.5 High-Level Architecture of a DSS

Components of DSS

- **Database Management System (DBMS)** − To solve a problem the necessary data may come from internal or external database.
  - *In an organization, internal data are generated by a system such as TPS and MIS.*
  - *External data come from a variety of sources such as newspapers, online data services, databases (financial, marketing, human resources).*
- **Model Management System** − It stores and accesses models that managers use to make decisions.
  - *Such models are used for designing manufacturing facility, analyzing the financial health of an organization, forecasting demand of a product or service, etc.*
- **Support Tools** − Support tools like online help; pulls down menus, user interfaces, graphical analysis, error correction mechanism, facilitates the user interactions with the system.

The Major Tools and Techniques of Managerial Decision Support

Computerized Tools for Decision Support

- Data management
- Reporting status tracking
- Visualization
- Business analytics
- Strategy and performance management
- Communication and collaboration
- Knowledge management
- Intelligent systems
- Enterprise systems

Classification of DSS

- There are several ways to classify DSS. Hoi Apple and Whinstone classifies DSS as follows −
- **Text Oriented DSS** − It contains textually represented information that could have a bearing on decision. It allows documents to be electronically created, revised and viewed as needed.
- **Database Oriented DSS** − Database plays a major role here; it contains organized and highly structured data.
- **Spreadsheet Oriented DSS** − It contains information in spread sheets that allows create, view, modify procedural knowledge and also instructs the system to execute self-contained instructions.
- **Solver Oriented DSS** − It is based on a solver, which is an algorithm or procedure written for performing certain calculations and particular program type.
- **Rules Oriented DSS** − It follows certain procedures adopted as rules.
  - Procedures are adopted in rules oriented DSS. Export system is the example.
- **Compound DSS** − It is built by using two or more of the five structures explained above.

Types of DSS

- Following are some typical DSSs −
- **Status Inquiry System** − It helps in taking operational, management level, or middle level management decisions.
  - *for example daily schedules of jobs to machines or machines to operators.*
- **Data Analysis System** − It needs comparative analysis and makes use of formula or an algorithm.
  - *for example cash flow analysis, inventory analysis etc.*
- **Information Analysis System** − In this system data is analyzed and the information report is generated.
  - *for example, sales analysis, accounts receivable systems, market analysis etc.*

Types of DSS

- **Accounting System** – It keeps track of accounting and finance related information, for example, final account, accounts receivables, accounts payables, etc. that keep track of the major aspects of the business.

- **Model Based System** – Simulation models or optimization models used for decision-making are used infrequently and creates general guidelines for operation or management.
  - *quantitative models used to generate a recommended solution to a problem*

A Work System View of Decision Support

- **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

- **Management support systems (MSS)**

  A system that applies any type of decision support tool or technique to managerial decision-making

A Work System View of Decision Support

- Nine elements of a work system
  1. *Business process*
  2. *Participants*
  3. *Information*
  4. *Technology*
  5. *Product and services*
  6. *Customers*
  7. *Infrastructure*
  8. *Environment*
  9. *Strategy*

Implementing Computer-Based Managerial Decision Support Systems

- Developing or acquiring support systems
- Justification and cost-benefit analysis
- Security and protection of privacy
- Integration of systems and applications
- The Web in DSS/BI implementation
  - *Information portals and MSS*