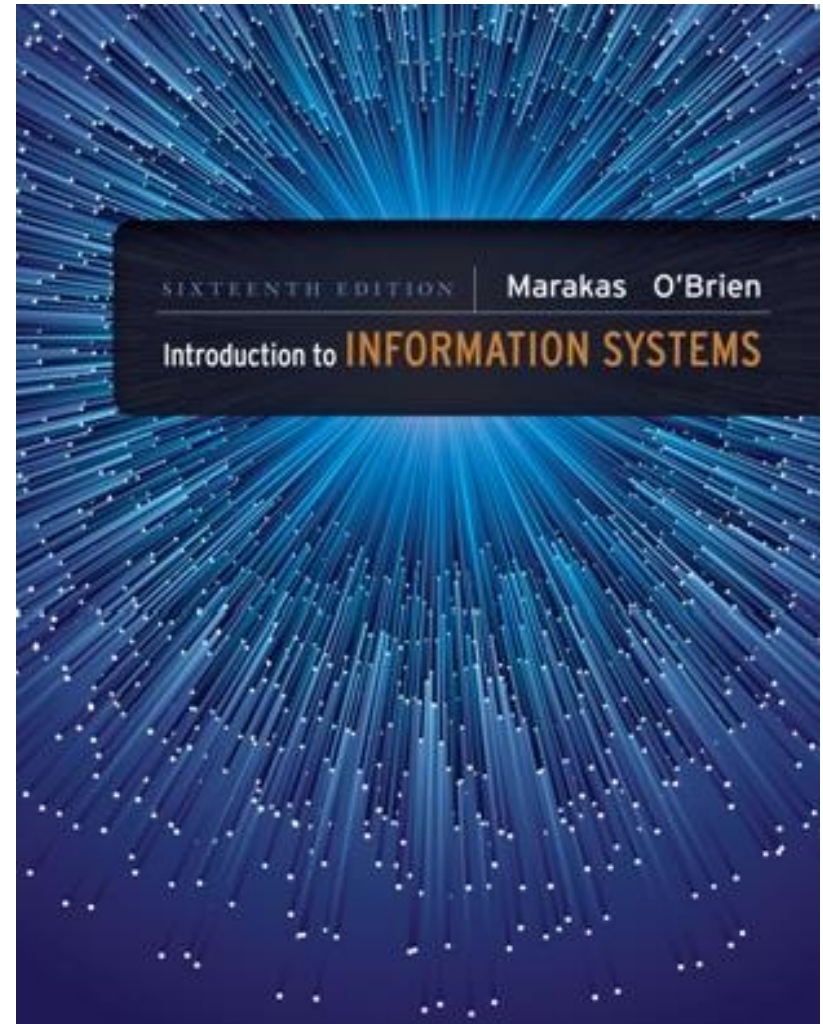# Chapter 1

**Part 2**

**Foundation Concepts: The Components of Information Systems**

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# Foundation Concepts:
# The Components of Information Systems

## SYSTEM CONCEPTS:
## THE FOUNDATION FOR BUSINESS PROCESSES

# The System

- A system is a *set of **interrelated components**, with a clearly defined boundary, working together to achieve a common set of objectives **by accepting inputs and producing outputs in an organized transformation process**.*

# The System (Cont.)

- **Systems have three basic functions:**

•**Input** involves capturing and assembling elements that enter the system to be processed.

•**Processing** involves transformation processes that convert input into output.

•**Output** involves transferring elements that have been produced by a transformation process to their ultimate destination.

Ex. Human breathing process

**FIGURE 1.16**

An example of a system: Interrelated components, in the form of pipes, meters, and valves, work together to supply energy to a large building.

SOURCE: © Brian Kennedy/Flickr/Getty Images.

# The System (Cont.)

**Feedback and Control**

**The system concept becomes even more useful** by including two additional elements: *feedback* and *control.*

•*Feedback* is data about the performance of a system.

•*Control* involves monitoring and evaluating feedback to determine whether a system is moving toward the achievement of its goal. The control function then makes the necessary adjustments to a system's input and processing components to ensure that it produces proper output.

**Ex.** Human everyday functions, airline pilot, … etc.

# The System (Cont.)

**Feedback and Control**

A system with **feedback** and **control** functions is

sometimes called a *cybernetic* system, that is, a

system that **is both self-monitoring** and **self-**

**regulating.**

**FIGURE 1.17**

A common cybernetic system is a home temperature control system. The thermostat accepts the desired room temperature as input and sends voltage to open the gas valve, which fires the furnace. The resulting hot air goes into the room, and the thermometer in the thermostat provides feedback to shut the system down when the desired temperature is reached.
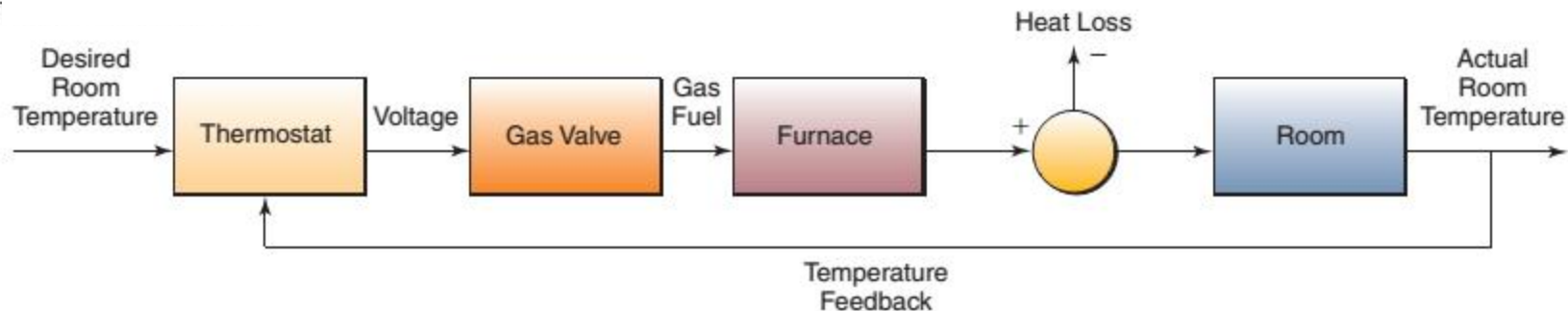
# Systems and subsystems

- A system does not exist in a vacuum.

- The system exists and functions in an *environment* containing other systems.

- If a system is one of the components of a larger system, it is referred to as a *subsystem,* and the larger system is its **environment**.

- Several systems may share the same environment.

- Some of these systems may be connected to one another by means of a **shared boundary**, called the *interface*.

- An *open system* is a system that interacts with other systems in its environment.

- The system which **exchanges** inputs and outputs **with its environment** is **connected** to its environment by input and output **interfaces**.

- A system that has the ability to **change itself or its environment** to **survive** is called an *adaptive system*.

## Stakeholders in the Business Environment

**Government Agencies** · **The Community** · **Competitors** · **Suppliers** · **Customers** · **Financial Institutions** · **Labor Unions** · **Stockholders**

**Control**

Management

↕

**Feedback**

Information Systems

**Economic Resources:**
- People
- Money
- Material
- Machines
- Land
- Facilities
- Energy
- Information

**Input**

**Business Processes:**
- Market, Develop, Produce, and Deliver Products and Services
- Support Customers
- Other Processes

**Processing**

**Goods and Services:**
- Products
- Services
- Payments
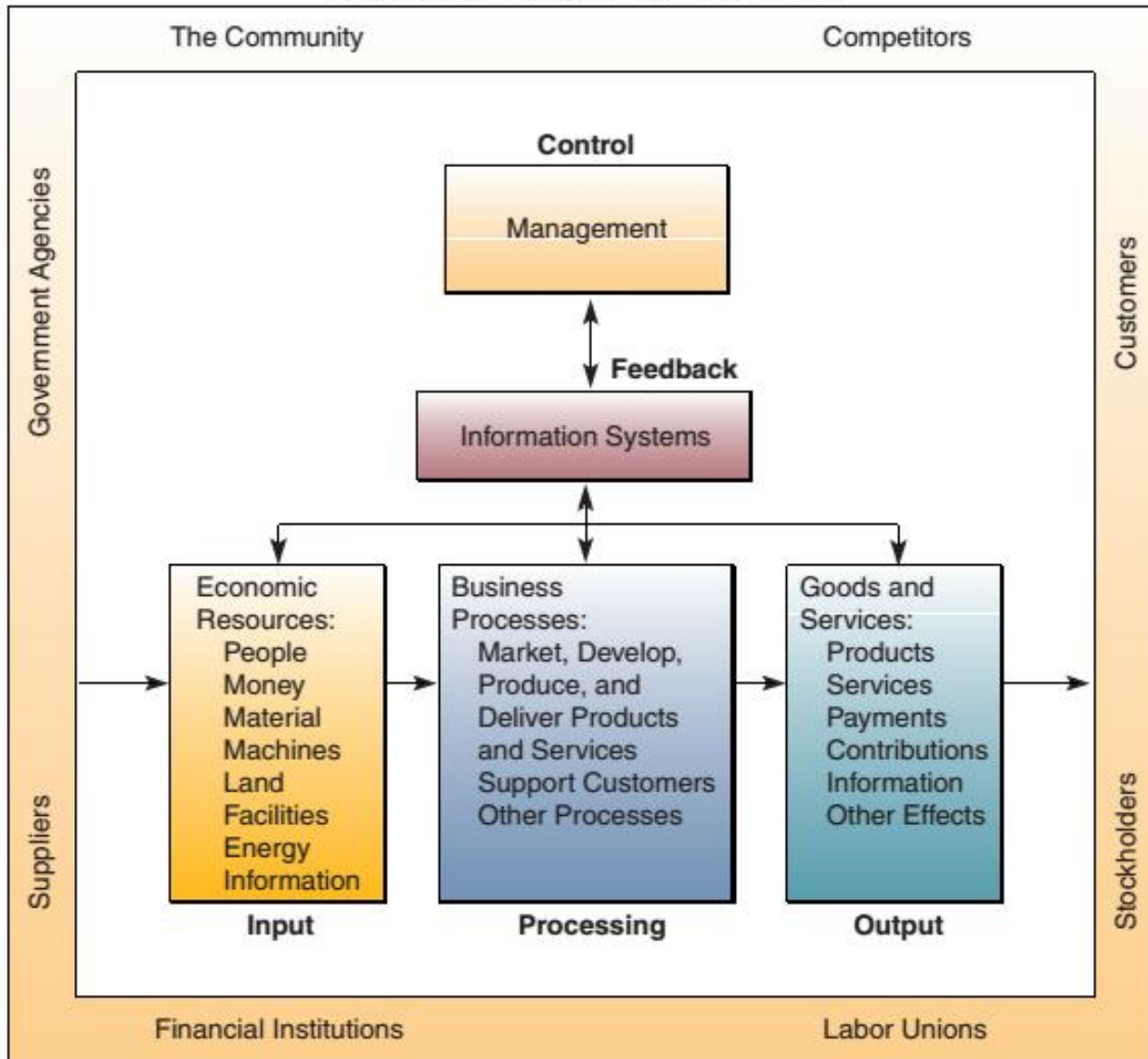- Contributions
- Information
- Other Effects

**Output**

**FIGURE 1.18**

A business is an example of an organizational system in which economic resources (input) are transformed by various business processes (processing) into goods and services (output). Information systems provide information (feedback) about the operations of the system to management for the direction and maintenance of the system (control) as it exchanges inputs and outputs with its environment.

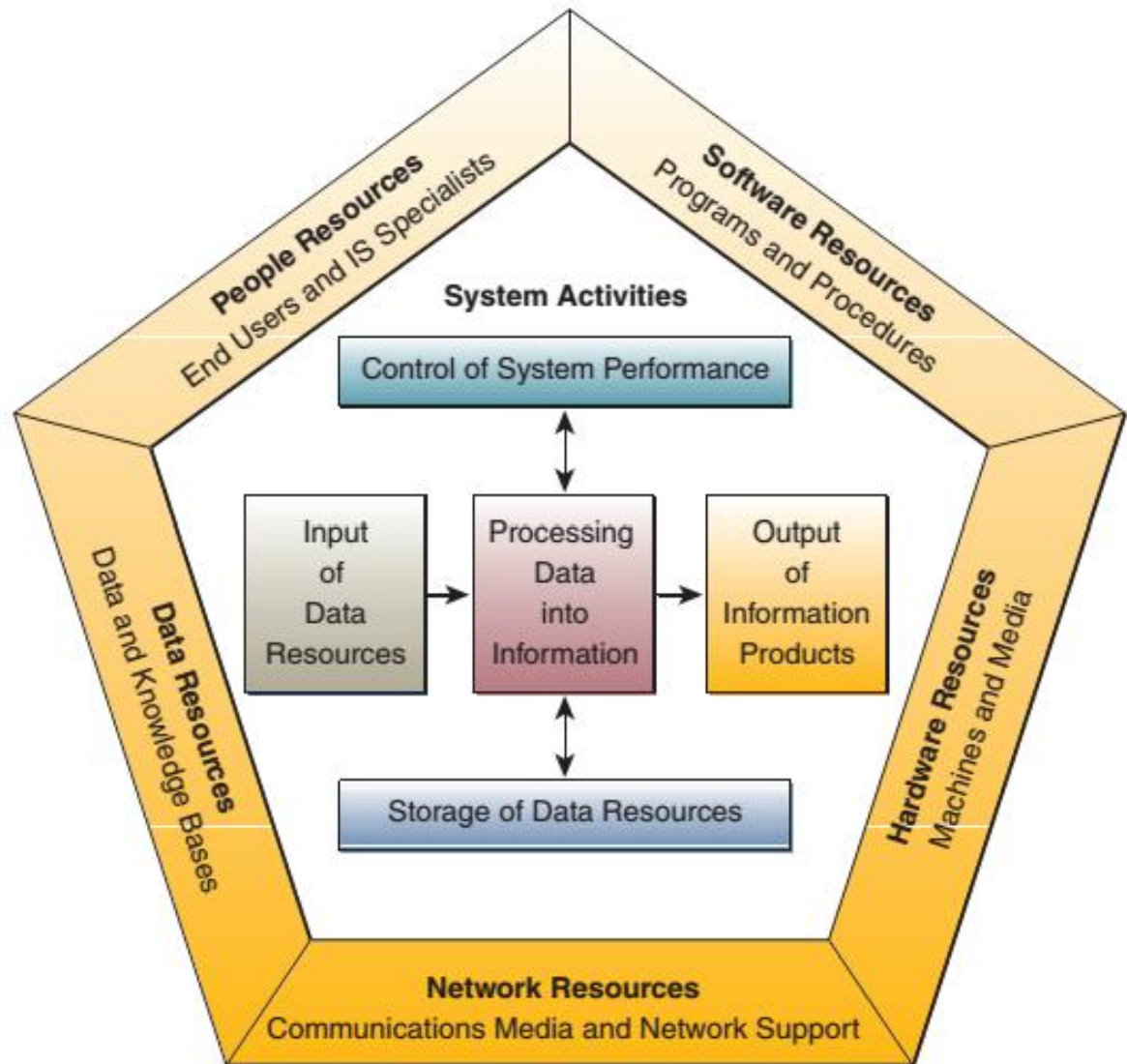# Applying system concepts to information systems

- Information systems are made up of **interrelated** components: People, hardware, software, peripherals, and networks.

- They have **clearly defined boundaries**: Functions, modules, type of application, department, or end-user group.

- All the interrelated components **work together** to achieve a common goal by accepting inputs and producing outputs in **an organized transformation process**: Using raw materials, hiring new people, manufacturing products for sale, and disseminating information to others.

- Information systems make extensive use of **feedback and control** to improve their effectiveness: **Error messages**, dialog boxes, **passwords**.

- Many information systems are designed to change in relation to their environments and are **adaptive**: Intelligent software **agents**, expert systems.

- **An *Information system* is a system that accepts *data resources* as *input* and *processes* them into *information products* as *output*.**

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# Foundation Concepts:
# The Components of Information Systems

## COMPONENTS OF INFORMATION SYSTEMS

## FIGURE 1.19

The components of an information system. All information systems use people, hardware, software, data, and network resources to perform input, processing, output, storage, and control activities that transform data resources into information products.



**People Resources**
End Users and IS Specialists

**Software Resources**
Programs and Procedures

**Data Resources**
Data and Knowledge Bases

**Hardware Resources**
Machines and Media

**Network Resources**
Communications Media and Network Support

**System Activities**

Control of System Performance

Input of Data Resources → Processing Data into Information → Output of Information Products

Storage of Data Resources

| Information System Resources and Products |
|---|
| **People Resources**<br>**Specialists**–systems analysts, software developers, systems operators.<br>**End Users**–anyone else who uses information systems. |
| **Hardware Resources**<br>**Machines**–computers, video monitors, magnetic disk drives, printers, optical scanners.<br>**Media**–floppy disks, magnetic tape, optical disks, plastic cards, paper forms, removable storage media. |
| **Software Resources**<br>**Programs**–operating system programs, spreadsheet programs, word processing programs, payroll programs.<br>**Procedures**–data entry procedures, error correction procedures, paycheck distribution procedures. |
| **Data Resources**<br>Product descriptions, customer records, employee files, inventory databases. |
| **Network** Resources<br>Communications media, communications processors, network access, control software. |
| **Information Products**<br>Management reports and business documents using text and graphics displays, audio responses, and paper forms. |

**FIGURE 1.20**

Examples of information system resources and products.

# People Resources

- *End users* (also called users or clients) are people who use an information system or the information it produces.

  - *knowledge workers,* people who spend most of their time communicating and collaborating in teams and workgroups and creating, using, and distributing information.

- *IS specialists* are people who develop and operate information systems.

# Hardware Resources

- The concept of *Hardware resources* includes all physical devices and materials used in information processing.
  - It includes *machines,* such as computers and other equipment,
  - and all data *media,* that is, tangible objects on which data are recorded, from sheets of paper to magnetic or optical disks.
- Examples of **hardware** in **computer-based information systems** are:
  - **Computer systems,** consist of **central processing units** containing microprocessors and a variety of interconnected peripheral devices such as printers, scanners, monitors, and so on.
    - Examples are handheld, laptop, tablet, or desktop microcomputer systems, midrange computer systems, and large mainframe computer systems.
  - **Computer peripherals,** which are devices such as a keyboard, electronic mouse, trackball, or stylus for the **input** of data and commands, a video screen or printer for the **output** of information, and magnetic or optical disk drives for the **storage** of data resources.

# Software Resources

- The concept of **software resources** includes all sets of information processing instructions.

- The following are examples of software resources:

  - **System software,** such as an operating system program, which controls and supports the operations of a computer system.

  - **Application software,** which are programs that direct processing for a particular use of computers by end users.

  - **Procedures,** which are operating instructions for the people who will use an information system. (Examples are instructions for filling out a paper form or using a software package.)

# Data Resources

- The concept of *data resources* **is any organizational resource** that must be managed effectively to benefit the organization.

- **Data are the lifeblood of today's organizations**, and the effective and efficient management of data is considered an integral part of organizational strategy.

- **Data can take many forms**, including traditional **alphanumeric data**, composed of numbers, letters, and other characters that describe business transactions and other events and entities; **text data**, consisting of  sentences and paragraphs used in written communications; **image data**, such as graphic shapes and figures or photographic and video images; and **audio data**, including the human voice and other sounds.

# Data Resources (Cont.)

- The **data resources** of information systems are typically **organized**, **stored**, and **accessed** by a variety of data **resource management technologies** into:

  - **Databases** that hold processed and organized data.

  - **Knowledge bases** that hold knowledge in a variety of forms, such as facts, rules, and case examples about successful business practices.

- **Data are objective measurements of the *attributes* (the characteristics) of *entities* (e.g., people, places, things, and events).**

- Data are usually subjected to **a value-added process** (*data processing* or *information processing*) during which:

  - (1) their form is aggregated, manipulated, and organized;

  - (2) their content is analyzed and evaluated; and

  - (3) they are placed in a proper context for a human user.

- The issue of **context** is really at the **heart** of understanding the **difference between information and data**.

# Network Resources

- The concept of *network resources* emphasizes that communications technologies and networks are fundamental resource components of all information systems.

- **Network resources** include:

  - **Communications media**. Examples include twisted-pair wire, coaxial and fiber-optic cables, and microwave, cellular, and satellite wireless technologies.

  - **Network infrastructure**. This generic category emphasizes that many **hardware, software, and data technologies** are needed to **support the operation and use** of a **communications network**.

    Examples include communications processors, such as modems and inter-network processors, and communications control software, such as network operating systems and Internet browser packages.

# Foundation Concepts:
# The Components of Information Systems

## INFORMATION SYSTEM ACTIVITIES

# *Information system activities*

- Regardless of the type of information system, the same basic ***information system activities*** **occur.**

**FIGURE 1.21**
Business examples of
the basic activities
of information systems.

| Information System Activities |
| --- |
| • **Input.** Optical scanning of bar-coded tags on merchandise. |
| • **Processing.** Calculating employee pay, taxes, and other payroll deductions. |
| • **Output.** Producing reports and displays about sales performance. |
| • **Storage.** Maintaining records on customers, employees, and products. |
| • **Control.** Generating audible signals to indicate proper entry of sales data. |

# Input of Data Resources

- **Input** typically takes the form of *data entry* activities such as recording and editing.

- End users usually **enter data directly into a computer** system or **record data about transactions** on some type of physical medium such as a paper form.

- *User interface* represents the methods of end-user input and output with a computer system.

- Methods such as **optical scanning** and **displays of menus**, prompts, and fill-in-the-blank formats make it easier for end users to **enter data correctly into an information system.**

# Processing of Data into Information

- Data are typically subjected to *processing* **activities,** such as calculating, comparing, sorting, classifying, and summarizing.

- These activities **organize, analyze, and manipulate** data, thus **converting them into information** for end users.

- The **quality** of any data stored in an information system **must also be maintained** by a continual process of **correcting and updating** activities.

# Output of Information Products

- Information in various forms is transmitted to end users and made available to them in the **output activity.**

- The goal of information systems is the production of appropriate *information products* **for end users.**

- Common **information products** include **messages**, **reports**, **forms**, and **graphic images**, which may be provided by video displays, audio responses, paper products, and multimedia.

# Storage of Data Resources

- **Storage** is the information system **activity** in which **data are retained** in an organized manner for later use.

- **Stored data** are commonly **organized** into a variety of data elements and **databases**.

- This organization **facilitates** their later use in processing or retrieval as output when needed by users of a system.

# Control of System Performance

- An information system should **produce feedback** about its input, processing, output, and storage activities.

- This **feedback must be monitored** and evaluated to determine whether the **system is meeting** established performance **standards**.

- Then appropriate system **activities** must be **adjusted** so that proper information products are produced for end users.

# Foundation Concepts:
# The Components of Information Systems

## RECOGNIZING INFORMATION SYSTEMS

# Recognizing information systems

- You should be able to **recognize** the **fundamental components of information systems** you encounter in the real world.

- You should be able to identify:

  - The **people**, **hardware**, **software**, **data**, and **network** resources they use.

  - The **types** of information **products** they produce.

  - The way they perform **input**, **processing**, **output**, **storage**, and control **activities**.

- This kind of **understanding** will help you be a **better user, developer, and manager** of information systems.