INFORMATION SYSTEMS AND SYSTEM DEVELOPMENT

Application of Information and Communication Technologies

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Learning Objectives

1. Understand what information systems are and why they are needed.
2. Explain who uses information systems in a typical organization.
3. Identify several types of information systems commonly found in organizations and describe the purpose of each.
4. Explain the individuals involved with system development.
5. Identify and describe the different steps of the system development life cycle (SDLC).
6. Discuss several approaches used to develop systems.

Overview

- This chapter covers:
  - How information systems are used and who uses them
  - Common types of information systems
  - Computer professionals who develop systems and their primary responsibilities
  - The system development life cycle (SDLC)
  - The major approaches to system development

What Is an Information System?

- System: Collection of elements and procedures that interact to accomplish a goal
  - Football game, transit systems, etc.

- Information system: A system used to generate the information needed to support the users in an organization

- System development: Process of designing and implementing a new or modified system

FIGURE 12-1
Components of an information system.
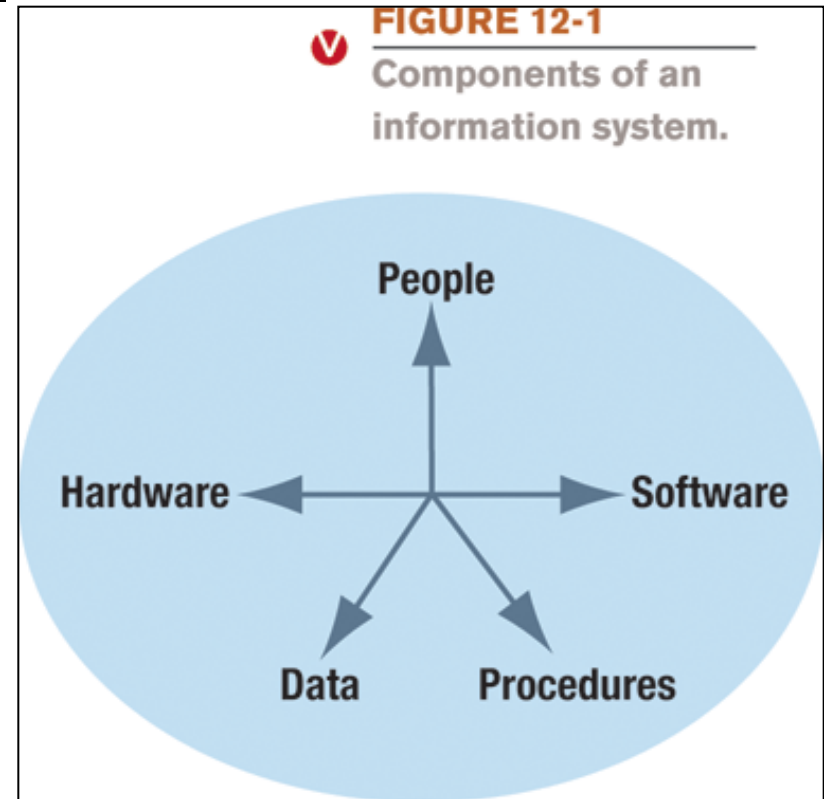
What Is an Information System?

- System development may be required because of:
  - New laws (Sarbanes-Oxely Act, HIPAA etc.)
  - Changes to the legal requirements for retaining business data (e-disclosure, etc.)
  - Introduction of new technology
- Enterprise architecture: Provides a detailed picture of an organization, its function, its systems, and the relationship among them
  - Allows managers to organize and maximize the use of IT resources and make better decisions
  - Not easy to develop and requires time and effort, but once in place, it is an invaluable decision support tool

What Is an Information System?

- **Business intelligence (BI):** The processes, technologies, and tools used to gather, store, access, and analyze data about a company

  - The information generated from BI systems is used to help decision makers

- **Data warehouse (data mart):** Comprehensive collection of data about a company and its customers

- **Data mining**: The use of intelligent software to find patterns that may not be otherwise evident

  - Can identify processes that need improvement

  - Web mining: Used in conjunction with Web data
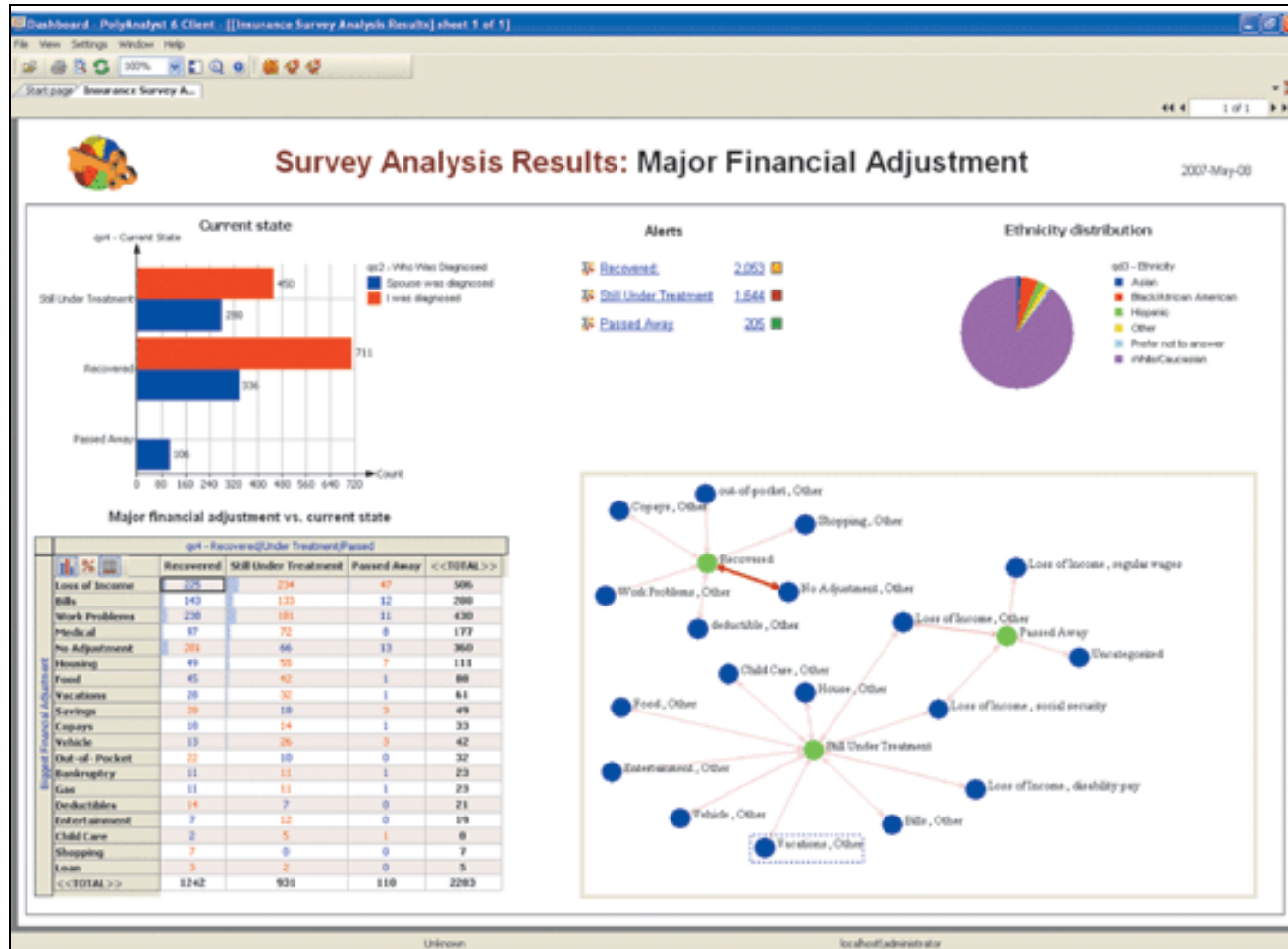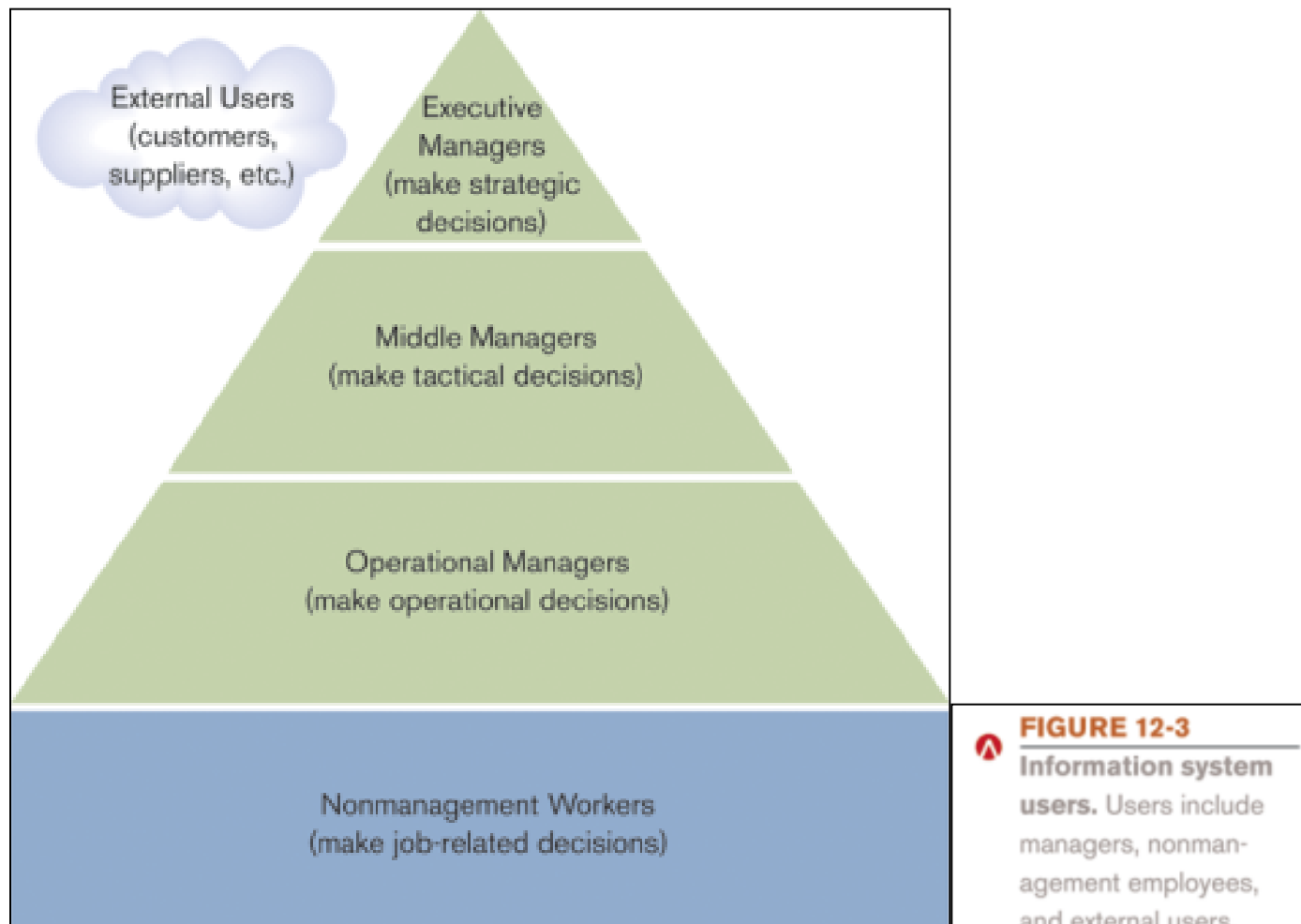
Business Intelligence

FIGURE 12-2
Data mining. The goal of data mining is to find patterns and relationships in data.

Information System Users

- Information systems can be:
  - Enterprise systems: Used throughout an entire enterprise (business, organization, agency)
  - Inter-enterprise systems: Links multiple enterprises, such as a business and its customers, suppliers and partners
  - Used by one person or all employees
  - Executive, middle, and operational managers
  - Non-management workers
  - External users (customers, suppliers, other partners, etc.)

Information Systems Users

External Users (customers, suppliers, etc.)

Executive Managers (make strategic decisions)

Middle Managers (make tactical decisions)

Operational Managers (make operational decisions)

Nonmanagement Workers (make job-related decisions)

FIGURE 12-3
Information system users. Users include managers, nonmanagement employees, and external users.

Types of Information Systems

- While hundreds of specific types of information systems exist, many fall into one of six categories

Types of Information Systems

- Office system: A system used to facilitate communications and enhance productivity
  - Document processing system: Used to create electronic documents
  - Document management system (DMS): Stores, organizes, and retrieves electronic documents
  - Content management system (CMS): DMS that also includes multimedia files and other content
  - Communications system: Allows employees to communicate with each other, with business partners, and with customers

Types of Information Systems

- Transaction processing system (TPS): Processes and records data created by an organization's business transactions
  - Usually processed in real time
  - Specialty systems used in law enforcement, the military, etc.

Types of Information Systems

- Types of transaction processing systems include:
  - Order entry systems
    - E-commerce systems
    - Point-of-sale (POS) systems
  - Payroll systems
  - Accounting systems
    - Accounts receivable systems
    - Accounts payable systems
    - General ledger systems

Types of Information Systems

- Decision making support systems: Help individuals make decisions
  - Management information system (MIS): Provides decision makers with preselected information
    - Usually provides information in the form of computer-generated reports
      - Detailed, summary, exception
    - Much of the time, this information is generated from data obtained from transaction processing
    - Most frequently used to make moderately structured, middle-management decisions

Management Information Systems (MISs)

Types of Information Systems

- Decision support system (DSS): Provides people with the tools and capabilities to organize and analyze their decision-making information
  - Typically used by upper management
  - Useful to anyone who requires unstructured or unpredictable information
  - Usually tailored to help with specific types of decisions (sales, transportation, etc.)
  - Incorporates internal and external data
  - Executive information system (EIS): A DSS targeted directly to upper management

Decision Support Systems (DSSs)

Types of Information Systems

- Geographic information system (GIS): Combines geographical information with other types of data to provide a better understanding of relationships among the data
  - Commonly used to make decisions about locations (e.g. new facility locations, disaster risk, geographical crime patterns)
  - Also used in disaster relief systems (after hurricane, etc.) to create search and rescue maps, maps of where electrical power is restored, etc.

Geographic Information Systems (GISs)

Types of Information Systems

- Integrated enterprise system: Designed to work together throughout an enterprise
  - Electronic data interchange (EDI): Transfers data between different companies using the Internet or another network
    - Often used to automate reordering materials and products
  - Enterprise resource planning (ERP): Large integrated system that ties together all of a business's activities
    - Enterprise application integration (EAI): Exchanging information from an ERP or other internal system among different applications and organizations

Types of Information Systems

- Inventory management system: Tracks and manages inventory
  - Can help optimize ordering
  - Supply chain management (SCM): Oversees materials, information, and finances as they move from the original supplier to the consumer
  - Just-in-time (JIT): Resources are limited to the right amount at the right time to fill orders
  - Warehouse management systems (WMS): Acts as a complete distribution system
  - Product lifecycle management (PLM): Organizes and correlates all information about a product from design to retirement

Types of Information Systems

Types of Information Systems

- Design and manufacturing systems: Use computers to automate the design and manufacturing functions
  - Computer-aided design (CAD)
  - Computer-aided manufacturing (CAM)

Types of Information Systems

- Artificial intelligence (AI) system: A system in which a computer performs actions that are characteristic of human intelligence
  - Turing Test and the Loebner Prize
  - Initial advances in AI made through chess-playing programs

Types of Information Systems

- Types of AI systems include:
  - Intelligent agents: Programs that perform specific tasks to help to make a user's work environment more efficient or entertaining and that typically modifies its behavior based on the user's actions
    - Application assistants
    - Shopping bots
    - Entertainment bots
    - Chatterbots
    - May be part of semantic Web

Types of Information Systems

- Expert system: Provides the type of advice that would be expected from a human expert
  - Knowledge base: Database containing facts provided by human experts and rules the system should use to make decisions based on those facts
  - Inference engine: Program that applies the rules to the data stored in the knowledge base, in order to reach decisions
  - Is only as good as the knowledge base and inference engine; also needs honest, correct information from the user in order to work correctly

Artificial Intelligence Systems

Types of Information Systems

- Neural network: A system in which the human brain's pattern-recognition process is emulated by the computer
  - Used in:
    - Handwriting, speech, and image recognition
    - Medical imaging
    - Crime analysis
    - Biometric identification
    - Vision systems (quality checks in manufacturing, recognizing postage stamps, etc.)

Types of Information Systems

- Robotics: The study of robot technology
- Robot: A device, controlled by a human operator or a computer, that can move and react to sensory input
  - Military robots
    - Investigate caves, buildings, trails, etc., before soldiers enter
    - Locate and defuse explosive devices
    - Surveillance
    - Exoskeltons are under development

Military Robots

Types of Information Systems

- Business robots used for:
  - Working on factory assembly lines
  - Mining coal, repairing oil rigs
  - Locating survivors/ rescues
  - Remote video-conferencing

Artificial Intelligence Systems

- Personal robots used for

  - Entertainment

  - Toys

  - Household tasks

- Societal implication of robots

Quick Quiz

1. A system using knowledge from medical experts that is used to help diagnose patients would be a type of
   a. neural network
   b. natural language system
   c. expert system

2. True or False: An order-entry system would be classified as a management information system.

3. A(n) _____ is a device, controlled by a human, that can move and react to sensory input.

Answers:

1) c; 2) False; 3) robot

Responsibility for System Development

- Information systems (IS) department: Responsible for that organization's computers, systems, and other technology
  - Also called the Information Technology (IT) department
  - Systems analyst: Studies systems in order to determine what work needs to be done, and how this work may best be achieved
  - Other IT personnel include:
    - Business analysts
    - Application programmers
    - Operations personnel
    - Security specialists

The IS Department

The IS Department

Responsibility for System Development

- Outsourcing: Hiring outside vendor to perform specific business tasks
  - Offshore outsourcing: Outsourced to another country
  - Nearshoring: Outsourcing to nearby countries
  - Homeshoring: Outsourcing to home-based workers
  - Crowdsourcing: Often performed via the Web
  - Captive offshoring: Own facilities
  - Security and privacy issues

Quick Quiz

1. Which term refers to outsourcing work to another country?

    a. Homeshoring

    b. Offshoring

    c. System development

2. True or False: The IT worker who codes computer programs is called the computer operator.

3. The IT employee most involved with system development is the _____.

Answers:

1) b; 2) False; 3) systems analyst

The System Development Life Cycle (SDLC)

- System development life cycle (SDLC): The development of a system from the time it is first studied until the time it is updated or replaced

The System Development Life Cycle (SDLC)

- **Preliminary investigation**: A feasibility study is performed to assess whether or not a full-scale project should be undertaken
  - Feasibility report: Contains findings on status of existing system and benefits/feasibility of changing to a new system
    - Includes recommendation regarding whether or not the project should move on to the next stage in the SDLC

The System Development Life Cycle (SDLC)

- **System analysis**: Examines the problem area to determine what should be done
  - Data collection: Gathering information about the system (organizational chart, observation, interviewing users, etc.)
  - Data analysis: Analyzing information to determine requirements for the new systems
  - Documentation: Any instruments used for data gathering and the resulting diagrams, trees, models, and other tools used to analyze the data

The System Development Life Cycle (SDLC)

- Data analysis tools include:
    - Entity-relationship diagrams (ERDs): Logical relationships among system entities
    - Data flow diagrams (DFDs): Flow of data through system
    - Decision tables and decision trees: Summarize decision process
    - Business process modeling notation (BPMN): Models business processes
    - Class diagrams and use case models: Object-oriented systems

Data Analysis Tools

Data Analysis Tools

The System Development Life Cycle (SDLC)

- System design: Specifies what the new system will look like and how it will work
  - Model of new system is developed; diagrams can include:
    - Data dictionary: Describes all data in a system
    - Data flow and/or class diagrams of the new system
    - Input/output designs
  - Cost/benefit analysis: Considers both tangible and intangible benefits to determine if the benefits of the new system outweigh the cost
  - Documentation: System design and specifications developed during the system design phase

System Design

The System Development Life Cycle (SDLC)

- **System acquisition**: The necessary hardware, software, and other system components are acquired
  - Make or buy decision: Need to determine if needed products will be purchased or developed in house
  - Software to be developed moves into the program development process (Chapter 13)
  - Products to be purchased need to be identified and a vendor selected
    - Can use RFP and/or RFQ
    - Bids need to be evaluated; vendor rating systems and benchmark tests can be helpful
  - Documentation: RFPs, RFQs, any vendor evaluation materials, etc.

System Acquisition

The System Development Life Cycle (SDLC)

- **System implementation**: The new system is installed, tested, and made operational
  - System must be thoroughly tested
    - Test data should be realistic and include incorrect data
  - Data needs to be prepared for data migration
  - System conversion: System is installed
  - User training (hands-on, users' manuals, etc.)
  - Documentation: Implementation schedule, test data, test results, training materials

The System Development Life Cycle (SDLC)

- Types of conversions:
  - Direct conversion: Old system deactivated; new system installed
  - Parallel conversion: Both old and new operated for a period of time
  - Phased conversion: New system implemented by module
  - Pilot conversion: New system installed at a pilot location initially

System Implementation

The System Development Life Cycle (SDLC)

- **System maintenance**: Minor adjustments are made to the finished system to keep it operational until the end of the system's life or until the time that the system needs to be redesigned
  - Post-implementation review: Identifies any glitches in the new system that need to be fixed
  - Maintenance is an ongoing process
  - When a major change is needed, the project goes through the SDLC again
  - Documentation: Completed project folder

Approaches to System Development

- Traditional system development: SDLC phases are carried out in the preset order
  - Referred to as the waterfall model
  - Time-consuming
  - Used primarily when system requirements are easy to determine, when the system is very familiar, or when management requests it
- Iterative approach: Steps are repeated until the system is finalized
  - Prototyping: Small model, or prototype, of the system is built before the full-scale development effort is undertaken

Approaches to System Development

- End-user development: User is primarily responsible for the development of the system
  - Most feasible when system being developed is small and inexpensive

Quick Quiz

1. The first step of in the system development life cycle is
   _____.

   a. to design the system

   b. to perform a preliminary investigation

   c. to implement the system

2. True or False: The traditional approach to systems development also is referred to as the waterfall model.

3. A test used to evaluate or measure a systems performance is called a(n) _____.

Answers:

1) b; 2) True; 3) benchmark test

Summary

- What Is an Information System?
- Types of Information Systems
- Responsibility for System Development
- The System Development Life Cycle (SDLC)
- Approaches to System Development