Chapter 7
Knowledge Management and Specialized Information Systems
Principles and Learning Objectives

• Knowledge management allows organizations to share knowledge and experience among managers and employees
  – Discuss the differences among data, information, and knowledge
  – Describe the role of the chief knowledge officer (CKO)
  – List some of the tools and techniques used in knowledge management
Artificial intelligence systems form a broad and diverse set of systems that can replicate human decision making for certain types of well-defined problems.

- Define the term artificial intelligence and state the objective of developing artificial intelligence systems.
- List the characteristics of intelligent behavior and compare the performance of natural and artificial intelligence systems for each of these characteristics.
- Identify the major components of the artificial intelligence field and provide one example of each type of system.
Principles and Learning Objectives (continued)

- Expert systems can enable a novice to perform at the level of an expert but must be developed and maintained very carefully
  - List the characteristics and basic components of expert systems
  - Outline and briefly explain the steps for developing an expert system
  - Identify the benefits associated with the use of expert systems
Principles and Learning Objectives (continued)

• Multimedia and virtual reality systems can reshape the interface between people and information technology by offering new ways to communicate information, visualize processes, and express ideas creatively
  – Discuss the use of multimedia in a business setting
  – Define the term virtual reality and provide three examples of virtual reality applications
Principles and Learning Objectives (continued)

• Specialized systems can help organizations and individuals achieve their goals
  – Discuss examples of specialized systems for organizational and individual use
Why Learn About Knowledge Management and Specialized Information Systems?

• Knowledge management and specialized information systems are used in almost every industry

• Learning about these systems:
  – Will help you discover new ways to use information systems in your day-to-day work
Knowledge Management Systems

- Data consists of raw facts
- Information:
  - Collection of facts organized so that they have additional value beyond the value of the facts themselves
- Knowledge:
  - Awareness and understanding of a set of information and the ways that information can be made useful to support a specific task or reach a decision
Knowledge Management Systems (continued)

• Knowledge management system (KMS):
  – Organized collection of people, procedures, software, databases, and devices
  – Used to create, store, share, and use the organization’s knowledge and experience
# Knowledge Management Systems

<table>
<thead>
<tr>
<th>Differences between data, information, and knowledge</th>
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<tbody>
<tr>
<td><strong>Data</strong></td>
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<tr>
<td><strong>Information</strong></td>
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<tr>
<td><strong>Knowledge</strong></td>
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</tbody>
</table>
Overview of Knowledge Management Systems

• Explicit knowledge:
  – Objective
  – Can be measured and documented in reports, papers, and rules

• Tacit knowledge:
  – Hard to measure and document
  – Typically not objective or formalized

• Many organizations attempt to convert tacit knowledge to explicit knowledge
Data and Knowledge Management
Workers and Communities of Practice

• Data workers:
  – Secretaries, administrative assistants, bookkeepers, data entry people, etc.

• Knowledge workers:
  – Create, use, and disseminate knowledge
  – Professionals in science, engineering, or business; writers; researchers; educators; corporate designers; etc.
Chief knowledge officer (CKO):
   - Top-level executive who helps the organization use a KMS to create, store, and use knowledge to achieve organizational goals

Communities of practice (COP):
   - Group of people dedicated to a common discipline or practice
   - May be used to create, store, and share knowledge
Obtaining, Storing, Sharing, and Using Knowledge

• Knowledge workers:
  – Often work in teams
  – Can use collaborative work software and group support systems to share knowledge

• Knowledge repository:
  – Includes documents, reports, files, and databases

• Knowledge map points the knowledge worker to the needed knowledge
Obtaining, Storing, Sharing, and Using Knowledge (continued)

**FIGURE 7.3 Knowledge management system**

Obtaining, storing, sharing, and using knowledge is the key to any KMS.
Technology to Support Knowledge Management

• Effective KMS:
  – Is based on learning new knowledge and changing procedures and approaches as a result

• Data mining and business intelligence can help capture and use knowledge

• IBM Lotus Notes and Microsoft Dashboard, Web Store Technology, and Access Workflow Designer are knowledge management tools
## TABLE 7.1 Additional Knowledge Management Organizations and Resources

<table>
<thead>
<tr>
<th>Company</th>
<th>Description</th>
<th>Web Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge Management Online</td>
<td>Provides online information, articles, and blogs on knowledge management</td>
<td><a href="http://www.knowledge-management-online.com/">http://www.knowledge-management-online.com/</a></td>
</tr>
<tr>
<td>CortexPro</td>
<td>Knowledge management collaboration tools</td>
<td><a href="http://www.cortexpro.com">www.cortexpro.com</a></td>
</tr>
<tr>
<td>Delphi Group</td>
<td>A knowledge management consulting company</td>
<td><a href="http://www.delphigroup.com">www.delphigroup.com</a></td>
</tr>
<tr>
<td>KM Knowledge</td>
<td>Knowledge management sites, products and services, magazines, and case studies</td>
<td><a href="http://www.kmknowledge.com">www.kmknowledge.com</a></td>
</tr>
<tr>
<td>Knowledge Management Solutions, Inc.</td>
<td>Tools to create, capture, classify, share, and manage knowledge</td>
<td><a href="http://www.kmsi.us">www.kmsi.us</a></td>
</tr>
<tr>
<td>KnowledgeBase</td>
<td>Content creation and management</td>
<td><a href="http://www.knowledgebase.com">www.knowledgebase.com</a></td>
</tr>
</tbody>
</table>

Fundamentals of Information Systems, Seventh Edition
An Overview of Artificial Intelligence

• Artificial intelligence (AI):
  – Computers with the ability to mimic or duplicate the functions of the human brain

• Computer systems that use the notion of AI:
  – Play Jeopardy
  – Help to make medical diagnoses
  – Pick and trade stocks
Artificial Intelligence in Perspective

• Artificial intelligence systems:
  – Include the people, procedures, hardware, software, data, and knowledge needed to develop computer systems and machines that demonstrate characteristics of intelligence
The Nature of Intelligence

• Turing Test:
  – Determines whether responses from a computer with intelligent behavior are indistinguishable from those from a human being

• Characteristics of intelligent behavior include the ability to:
  – Learn from experiences and apply knowledge acquired from experience
  – Handle complex situations
  – Solve problems when important information is missing
The Nature of Intelligence (continued)

• Characteristics of intelligent behavior include the ability to (continued):
  – Determine what is important
  – React quickly and correctly to a new situation
  – Understand visual images
  – Process and manipulate symbols
  – Be creative and imaginative
  – Use heuristics
The Brain Computer Interface

- Brain Computer Interface (BCI):
  - Idea is to directly connect the human brain to a computer and have human thought control computer activities

- If successful:
  - The BCI experiment will allow people to control computers and artificial arms and legs through thought alone
The Major Branches of Artificial Intelligence

• AI is a broad field that includes:
  – Expert systems and robotics
  – Vision systems and natural language processing
  – Learning systems and neural networks

• Expert systems:
  – Hardware and software that stores knowledge and makes inferences, similar to a human expert
The Major Branches of Artificial Intelligence (continued)

Figure 7.5
A Conceptual Model of Artificial Intelligence

- Robotics
- Vision systems
- Learning systems
- Natural language processing
- Expert systems
- Neural networks
Robotics

• Developing mechanical devices that can:
  – Paint cars, make precision welds, and perform other tasks that require a high degree of precision

• Manufacturers use robots to assemble and paint products

• Contemporary robotics:
  – Combine both high-precision machine capabilities and sophisticated controlling software
Vision Systems

• Hardware and software that permit computers to capture, store, and manipulate visual images and pictures
• Effective at identifying people based on facial features
Natural Language Processing and Voice Recognition

• Processing that allows the computer to understand and react to statements and commands made in a “natural” language, such as English

• Voice recognition:
  – Converting sound waves into words
Learning Systems

• Combination of software and hardware that:
  – Allows the computer to change how it functions or reacts to situations based on feedback it receives

• Learning systems software:
  – Requires feedback on results of actions or decisions
Neural Networks

• Computer system that simulates functioning of a human brain
• Can process many pieces of data at the same time and learn to recognize patterns
• Neural network program:
  – Helps engineers slow or speed drilling operations to help increase drilling accuracy and reduce costs
Other Artificial Intelligence Applications

• Genetic algorithm:
  – Approach to solving complex problems in which a number of related operations or models change and evolve until the best one emerges

• Intelligent agent:
  – Programs and a knowledge base used to perform a specific task for a person, a process, or another program
An Overview of Expert Systems

• Computerized expert systems:
  – Use heuristics, or rules of thumb, to arrive at conclusions or make suggestions

• The U.S. Army:
  – Uses the Knowledge and Information Fusion Exchange (KnIFE) expert system to help soldiers in the field make better military decisions
When to Use Expert Systems

• People and organizations should develop an expert system if it can:
  – Provide a high potential payoff or significantly reduce downside risk
  – Capture and preserve irreplaceable human expertise
  – Solve a problem that is not easily solved using traditional programming techniques
  – Develop a system more consistent than human experts
When to Use Expert Systems
(continued)

• People and organizations should develop an expert system if it can (continued):
  – Provide expertise needed at a number of locations at the same time or in a hostile environment that is dangerous to human health
  – Provide expertise that is expensive or rare
  – Develop a solution faster than human experts can
  – Provide expertise needed for training and development
Components of Expert Systems

• Expert system:
  – Consists of a collection of integrated and related components

• Knowledge base:
  – Stores all relevant information, data, rules, cases, and relationships used by expert system
  – Creates knowledge base by:
    • Using rules
    • Using cases
Components of Expert Systems (continued)
The Inference Engine

• Purpose:
  – To seek information and relationships from the knowledge base
  – To provide answers, predictions, and suggestions, like a human expert
The Explanation Facility

• Allows a user or decision maker to understand how the expert system arrived at certain conclusions or results

• Example:
  – A doctor can find out the logic or rationale of a diagnosis made by a medical expert system
The Knowledge Acquisition Facility

• Provides convenient and efficient means of capturing and storing all components of knowledge base

• Knowledge acquisition software:
  – Can present users and decision makers with easy-to-use menus
The knowledge acquisition facility acts as an interface between experts and the knowledge base.
The User Interface

• Permits decision makers to develop and use their own expert systems

• Main purpose:
  – To make development and use of an expert system easier for users and decision makers
Participants in Developing and Using Expert Systems

• Domain expert:
  – Person or group with the expertise or knowledge the expert system is trying to capture

• Knowledge engineer:
  – Person who has training or experience in the design, development, implementation, and maintenance of an expert system

• Knowledge user:
  – Person or group who uses and benefits from the expert system
Participants in Developing and Using Expert Systems (continued)
Expert Systems Development Tools and Techniques

• Theoretically, expert systems can be developed from any programming language

• Expert system shells and products:
  – Collections of software packages and tools used to design, develop, implement, and maintain expert systems
<table>
<thead>
<tr>
<th>Name of Product</th>
<th>Application and Capabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exsys Corvid</td>
<td>An expert system tool that simulates a conversation with a human expert from Exsys (<a href="http://www.exsys.com">www.exsys.com</a>)</td>
</tr>
<tr>
<td>EZ-Xpert</td>
<td>A rule-based expert system that results in complete applications in the C++ or Visual Basic programming languages by EZ-Xpert (<a href="http://www.ez-xpert.com">www.ez-xpert.com</a>)</td>
</tr>
<tr>
<td>G2</td>
<td>Assists in oil and gas operations; Transco, a British company, uses it to help in the transport of gas to more than 20 million commercial and domestic customers</td>
</tr>
<tr>
<td>HazMat Loader</td>
<td>Analyzes hazardous materials in truck shipments (<a href="http://hazmat.dot.gov">http://hazmat.dot.gov</a>)</td>
</tr>
<tr>
<td>Imprint Business Systems</td>
<td>Has an expert system that helps printing and packaging companies manage their businesses (<a href="http://www.imprint-mis.co.uk">www.imprint-mis.co.uk</a>)</td>
</tr>
<tr>
<td>Lantek Expert System</td>
<td>Helps metal fabricators reduce waste and increase profits (<a href="http://www.lantek.es">www.lantek.es</a>)</td>
</tr>
<tr>
<td>RAMPART</td>
<td>Developed by Sandia National Laboratories, the U.S. General Services Administration (GSA) uses it to analyze risk to the approximately 8,000 federal buildings it manages (<a href="http://www.sandia.gov">www.sandia.gov</a>)</td>
</tr>
</tbody>
</table>
Multimedia and Virtual Reality

• Use of multimedia and virtual reality:
  – Has helped many companies achieve a competitive advantage and increase profits

• The approach and technology used in multimedia:
  – Is often the foundation of virtual reality systems
Overview of Multimedia

• Multimedia is:
  – Text and graphics
  – Audio
  – Video and animation
  – File conversion and compression

• Designing a multimedia application:
  – Requires careful thought and a systematic approach
  – Requires that the end use of the document or file be carefully considered
Overview of Virtual Reality

• Virtual reality system:
  – Enables one or more users to move and react in a computer-simulated environment

• Immersive virtual reality:
  – User becomes fully immersed in an artificial, 3D world that is completely generated by a computer
Interface Devices

• To see in a virtual world:
  – Often the user wears a head-mounted display (HMD) with screens directed at each eye

• Haptic interface:
  – Relays sense of touch and other sensations in a virtual world
  – Most challenging to create
Forms of Virtual Reality

• Immersive virtual reality
• Applications that are not fully immersive:
  – Mouse-controlled navigation through a 3D environment on a graphics monitor
  – Stereo projection systems
  – Stereo viewing from the monitor via stereo glasses
Virtual Reality Applications

• Medicine:
  – VR program called SnowWorld helps treat burn patients

• Education and training:
  – Virtual technology has also been applied by the military
Virtual Reality Applications (continued)

• Business and Commerce:
  – Boeing used virtual reality to help it design and manufacture airplane parts and new planes

• Entertainment:
  – Movies use CGI to bring realism to the silver screen
Specialized Systems

• Segway:
  – Uses sophisticated software, sensors, and gyro motors to transport people

• Radio Frequency Identification (RFID) tags:
  – Contain small chips with information about products or packages
  – Can be quickly scanned to perform inventory control
Specialized Systems (continued)

• Game theory:
  – Involves the use of information systems to develop competitive strategies for people, organizations, or even countries

• Informatics:
  – Combines traditional disciplines, such as science and medicine, with computer systems and technology
Summary

• Knowledge:
  – Awareness and understanding of a set of information

• Knowledge workers:
  – People who create, use, and disseminate knowledge

• Artificial intelligence:
  – Broad field that includes:
    • Expert systems, robotics, vision systems
    • Natural language processing, learning systems, and neural networks
Summary (continued)

• Expert system consists of a collection of integrated and related components

• Inference engine:
  – Processes the rules, data, and relationships stored in the knowledge base

• Virtual reality system:
  – Enables one or more users to move and react in a computer-simulated environment
Summary (continued)

• Virtual reality:
  – Can refer to applications that are not fully immersive

• Specialized systems:
  – Segway
  – Radio Frequency Identification (RFID) tags
  – Game theory