

CHAPTER 15

Managing Knowledge

LEARNING OBJECTIVES

After reading this chapter, you will be able to answer the following questions:

1. What is the role of knowledge management and knowledge management programs in business?
2. What types of systems are used for enterprise-wide knowledge management and how do they provide value for businesses?
3. What are the major types of knowledge work systems and how do they provide value for firms?
4. What are the business benefits of using intelligent techniques for knowledge management?

OPENING CASE: CONTENT MANAGEMENT FOR ROYAL CANADIAN MINT: HOW TO MAXIMIZE YOUR WEB PRESENCE

Royal Canadian Mint's experience shows how organizational performance can benefit by making organizational knowledge more easily available. By organizing its knowledge about its products and its inventory, and making it more accessible and customizable on its Web site, the Mint increased its efficiency and ability to serve customers. A large part of their solution was using content management tools to allow non-technical staff to update the information on the Web site.

The chapter-opening diagram calls attention to important points raised by this case and this chapter. Southern Company is highly document-intensive. Much of the essential information and knowledge for running the company was not easily accessible because it was stored in many different legacy systems and platforms. By bringing together the product information into one system, the Web site can deliver personalized information for each customer. In addition to providing superior customer service, the integrated system allows orders to be fed directly into the order-entry system, and processed without human intervention. The new system has made the Mint more efficient and profitable, and improved customer satisfaction.

15.1 THE KNOWLEDGE MANAGEMENT LANDSCAPE

As we've mentioned in other chapters, knowledge is becoming recognized as an important corporate resource that must be captured, protected, preserved, and grown. How you do that is the focus of this chapter.

Creating and using knowledge is not limited to information-based companies; it is necessary for all organizations, regardless of industry sector. It's not enough to make good products. Companies must make products that are better, less expensive to produce, and more desirable than those of competitors'. Using corporate and individual knowledge assets wisely will help companies do that.

IMPORTANT DIMENSIONS OF KNOWLEDGE

In Chapter 1 we discussed the difference between computer literacy and information literacy. We pointed out that there is more to information than just bits and bytes. In that chapter, we defined **data** as a flow of events or transactions captured by an organization's systems that, by itself, is useful for transacting but little else. The next step up from information literacy is **knowledge**. An organization must transform the information it gathers and put it into meaningful concepts that give it insight into ways of improving the environment for its employees, suppliers, and customers. **Wisdom** is using information to solve problems and knowing when, where, and how to apply knowledge.

There is an important distinction between tacit knowledge and explicit knowledge. You may have experienced the long-time employee that seems to know how to fix the intricate piece of machinery in his sleep. He or she has been doing it for years, he or she would tell you. All of the knowledge he or she retains in his mind is **tacit knowledge**. On the other hand, you may have dealt with an employee who seems to grab the operating manual every time he or she turns around. The manual is an example of **explicit knowledge** — that which is documented.

Every organization has all four of these dimensions of knowledge. How it handles them is what can make the organization a successful one that seems to outrun the competition, or one that seems to muddle through the best it can.

Table 15-1 below contains an excellent synopsis of organizational knowledge. Students can apply it to an organization with which they are familiar and determine how well it values knowledge as an asset.

KNOWLEDGE IS A FIRM ASSET

Knowledge is an intangible asset.

The transformation of data into useful information and knowledge requires organizational resources.

Knowledge is not subject to the law of diminishing returns as are physical assets, but instead experiences network effects as its value increases as more people share it.

KNOWLEDGE HAS DIFFERENT FORMS

Knowledge can be either tacit or explicit (codified).

Knowledge involves know-how, craft, and skill.

Knowledge involves knowing how to follow procedures.

Knowledge involves knowing why, not simply when, things happen (causality).

KNOWLEDGE HAS A LOCATION

Knowledge is a cognitive event involving mental models and maps of individuals.

There is both a social and an individual basis of knowledge.

Knowledge is "sticky" (hard to move), situated (enmeshed in a firm's culture), and contextual (works only in certain situations).

KNOWLEDGE IS SITUATIONAL

Knowledge is conditional: Knowing when to apply a procedure is just as important as knowing the procedure (conditional).

Knowledge is related to context: You must know how to use a certain tool and under what circumstances.

Organizational Learning and Knowledge Management

In the last few years, companies have downsized and flattened their organizations. Many employees who were laid off had been with these companies for years. When they walked out the door, they took experience, education, contacts, and information with them. Companies are finding out how important human resources are to their success and are establishing **organizational learning** mechanisms to capture and use the corporate knowledge.

Companies that want to flourish must continually adapt and change to meet the growing demands of doing business in tomorrow's environment. Employees must adjust to new challenges and new technologies. How well they do so is a reflection of the organization's ability to acquire and apply knowledge to changing situations through its organizational learning mechanisms.

THE KNOWLEDGE MANAGEMENT VALUE CHAIN

To understand the concept of **knowledge management**, think of knowledge as a resource, just like buildings, production equipment, product designs, and money. All these resources need to be systematically and actively managed.

Figure 15-2 illustrates the activities that go into successfully managing knowledge from acquiring it to applying it throughout the firm. It's not just technology related to the activities that's important to recognize. In fact, as the text points out, technology

applications of managing knowledge account for only about 20 percent. The other 80 percent deals with organizing and managing the knowledge assets.

Knowledge Acquisition

Knowledge comes from a variety of sources. Early attempts of gathering knowledge were a hodgepodge of documents, reports, and employee input. Now companies are using more sophisticated technologies to gather information and knowledge from emails, transaction-processing systems, and outside sources such as news reports and government statistical data. It's important to remember that a great deal of knowledge should come from external sources since no organization exists in a vacuum.

Knowledge Storage

Remember, knowledge management is a continual process, not an event. As you gather knowledge you must store it efficiently and effectively. **Document management systems** are an easy way to digitize, index, and tag documents so that employees can retrieve them without too much difficulty. Probably the most important element of any knowledge system is the people that feed the machine. One of the biggest reasons knowledge systems have failed in the past is because the employees and management either didn't place enough importance on the system or felt threatened by it. All the people in the digital firm need to realize how important knowledge is and help take care of the system.

Knowledge Dissemination

Once you've built the system, acquired and stored the knowledge, you need to make it easy and efficient for employees to access the knowledge. Everyone complains nowadays of having too much information. The organization needs to make knowledge dissemination unobtrusive and easy to master or the employees and managers will ignore it or underutilize it.

Knowledge Application

You can have all the information and knowledge you need to master any task, but if you don't build the knowledge dissemination into every functional area and every system used throughout the organization you are doing a disservice to both the knowledge and the company. As old systems are revamped and revised or new ones built, pay attention to how you can draw knowledge into them. The digital firm also needs to explore how it can use the knowledge system to build new processes for its suppliers and employees or new products for its customers. Once it masters that, it can outrun the competition and build a stronger organization.

Building Organization and Management Capital: Collaboration, Communities of Practice, and Office Environments

As knowledge becomes a central productive and strategic asset, the success of the organization increasingly depends on its ability to gather, produce, maintain, and disseminate knowledge. One way companies are responding to the challenge is by appointing a **chief knowledge officer**. His/her responsibilities involve designing new programs, systems, and methods for capturing and managing knowledge. In some cases,

the hardest part of the CKO's job may be convincing the organization that it needs to capture, organize, and use its corporate knowledge to remain competitive.

“Basically, the CKO concept is rooted in the realization that companies can no longer expect that the products and services that made them successful in the past will keep them viable in the future. Instead, companies will differentiate themselves on the basis of what they know and their ability to know how to do new things well and quickly.”
(Business.com Web site)

No one person has all the knowledge a digital firm needs. For that you must rely on many different people from many different locations. **Communities of practice (COP)** are built on the idea of combining ideas and knowledge from various sources and making it available to people inside and outside the organization. Professional conferences, newsletters, journals, and online newsgroups are excellent sources of information that center on the communities of practice concept.

Four areas where COP can make a difference are:

- Reuse knowledge
- Facilitate gathering new information
- Reduce learning curves
- Act as a spawning ground for new knowledge

TYPES OF KNOWLEDGE MANAGEMENT SYSTEMS

There are three major types of knowledge management systems as shown in Figure 15-2.

Enterprise knowledge management systems are spread across the organization and offer a way to systematically complete the information system activities we just reviewed: acquiring, storing, disseminating, and applying knowledge.

Knowledge work systems use powerful workstations that can process the huge graphics files some professionals need or to perform the massive calculations other types of professionals require. We're not talking clip art or simple adding or subtracting. We're talking huge amounts of data that must be processed quickly and the necessary storage for large files. The workstations must also have the necessary equipment and telecommunication connections that enable the knowledge workers to connect to external sources of information via extranets, intranets, or the Internet. These systems must have system and application software that is easy-to-use and manipulate, and intuitive to learn so the workers can “get right to it.”

Intelligent techniques, which we'll look at more closely at the end of this chapter, include expert systems, neural networks, and genetic algorithms, to name a few.

Bottom Line: Knowledge is an important asset that must be managed throughout the enterprise. Knowledge must be acquired, stored, distributed, and applied effectively and efficiently. The Chief Knowledge Officer is responsible for ensuring that the digital firm uses its knowledge assets wisely.

15.2

ENTERPRISE-WIDE KNOWLEDGE MANAGEMENT SYSTEMS

With so many sources of information and knowledge available, how does an organization go about collecting, storing, distributing, and applying all of it? That's what we'll investigate in this section.

ENTERPRISE CONTENT MANAGEMENT SYSTEMS

Traditionally, knowledge wasn't considered a corporate resource. Many systems were built without the necessary infrastructure for gathering, storing, and retrieving knowledge. That started changing in the late 1980s and early 1990s when companies started realizing how much knowledge was lying dormant in text documents and reports. The **structured knowledge systems** were the first attempts at capturing this type of knowledge and making it easily available to a wider range of people inside the organization.

As people started using newer forms of communications such as emails, chat rooms, voice mail, and digital-based reports, graphics, and presentations, organizations had to adapt their systems to accommodate the **semi structured knowledge**. Sometimes referred to as digital asset management systems, these semi structured knowledge systems piggybacked on the more rigidly structured knowledge systems to incorporate a wider range of information.

Organizations can create a centralized **knowledge repository** by building upon document management systems and including information from the structured and semi structured knowledge systems. The knowledge repository is then easily accessed by employees throughout the organization and can also be properly managed by the CKO.

KNOWLEDGE NETWORK SYSTEMS

Because it's simply too expensive and too time-consuming to continually reinvent the wheel, corporations are turning to **knowledge networks systems** in an attempt to link those who hold the knowledge with those that need the knowledge. Employees who have the tacit knowledge about a product or project in their head are easily connected with employees who need to know the information through these kinds of networks. Corporations save time and money by placing data pertaining to the subject matter experts in a directory that all employees can access. Users are easily connected to the experts through these networks and can communicate and collaborate on a variety of

subjects. Once captured and recorded in structured documents and reports, this corporate asset is referred to as **structured knowledge**.

COLLABORATION TOOLS AND LEARNING MANAGEMENT SYSTEMS

The major enterprise content management systems include powerful portal and collaboration technologies. Enterprise knowledge portals can provide access to external sources of information, such as news feeds and research, as well as to internal knowledge resources along with capabilities for e-mail, chat/ instant messaging, discussion groups, and videoconferencing.

Companies are starting to use consumer Web technologies such as blogs, wikis, and social bookmarking for internal use to foster collaboration and information exchange between individuals and teams. Blogs and wikis help capture, consolidate, and centralize this knowledge for the firm. Collaboration tools from commercial software vendors, such as Microsoft SharePoint and Lotus Connections, also offer these capabilities along with secure online collaborative workspaces.

Wikis provide a central repository for all types of corporate data that can be displayed in a Web browser, including electronic pages of documents, spreadsheets, and electronic slides, and can embed e-mail and instant messages. Although users are able to modify wiki content contributed by others, wikis have capabilities for tracking these changes and tools for reverting to earlier versions. A wiki is most appropriate for information that is revised frequently but must remain available perpetually as it changes.

Social bookmarking makes it easier to search for and share information by allowing users to save their bookmarks to Web pages on a public Web site and tag these bookmarks with keywords. These tags can be used to organize and search for the documents. Lists of tags can be shared with other people to help them find information of interest. The user-created taxonomies created for shared bookmarks are called **folksonomies**. Delicious and Digg are two popular social bookmarking sites. The Window on Technology on page 478 describes this technology and its uses for knowledge management.

Companies need ways to keep track of and manage employee learning and to integrate it more fully into their knowledge management and other corporate systems. A **learning management system (LMS)** provides tools for the management, delivery, tracking, and assessment of various types of employee learning and training.

Contemporary LMS support multiple modes of learning, including CD-ROM, downloadable videos, Web-based classes, live instruction in classes or online and group learning in online forums and chat sessions. The LMS consolidates mixed-media training, automates the selection and administration of courses, assembles and delivers learning content, and measures learning effectiveness.

For example, the Credit Union Institute of Canada (CUIC) uses Docent Inc.'s enterprise suite as the infrastructure for its e-learning solution. With more than 650 credit union members spread across the nation, organizing a solution was no simple task. But the solution delivers e-learning to member credit unions and/ or their employees, so that if a local credit union decides not to offer education and training through the learning management system, a local credit union employee can still take advantage of the system to receive training.

Because business processes and work methods are constantly and continually changing, organizations must devise ways to make learning less expensive and easier to deliver. By using a **learning management system** to provide the necessary tools for delivering, tracking, and assessing employee learning, companies can reduce costs and ensure employees receive the right training at the right time. A company can make these systems even more productive if they are used in conjunction Web-based multimedia systems. Regardless of where the employee and educator are located, they can collaborate together whenever necessary.

WINDOW ON MANAGEMENT: MANAGING WITH WEB 2.0

TO THINK ABOUT QUESTIONS

1. How do Web 2.0 tools help companies manage knowledge, coordinate work, and enhance decision making?

Blogs, wikis, and social networking are emerging as powerful tools to boost communication and productivity in the corporate workforce. Workers and managers are using wikis to store information and share memos. IBM created a wiki to help 50 of its experts collaborate on an intellectual property manifesto. Another IBM manager uses wikis to give him “a single view of the projects and their status” without sending numerous e-mails to each of his workers. IBM is also using social networking to help employees communicate better with each other. Dresdner Kleinwort investment bank uses corporate wikis for collaborating on materials related to meetings, supporting brainstorming sessions, and developing presentations.

2. What business problems do blogs, wikis, and other social networking tools help solve?

These tools reduce the need for e-mail and its inherent problems like storage, transmission bandwidth, and lack of searchability. Information is stored in one place with blogs and wikis. Employees and managers can communicate and collaborate with each other faster and easier. Decision-making is enhanced by the speed with which these tools allow managers to research and gather information. Because the tools are easier and cheaper to deploy, companies reduce the costs of knowledge management and decision-making.

3. Describe how a company such as Air Canada or Sobeys would benefit from using Web 2.0 tools internally.

Answers will vary but students should address the ease of use, lower deployment costs, and improved collaboration and communication that these tools provide.

4. What challenges do companies face in spreading the use of Web 2.0? What issues should managers be concerned with?

The biggest challenge to using these tools is convincing workers to use them and in regulating their use. Companies must enforce rules of privacy, respect, and confidentiality in its corporate code of conduct and not allow any anonymous online communication.

MIS IN ACTION QUESTIONS

Go to Sun Microsystems Blogs home page at <http://blogs.sun.com> and click the **Blog Directory** tab. Select a blog from the directory and then answer the following questions:

Obviously the answers to the questions below will vary among students (or least they should). One of the most interesting blogs on Sun's site is that of CEO Jonathan Swartz (here's the link: <http://blogs.sun.com/jonathan/>). His blog is very easy to read and contains interesting information. He tends to keep it light-hearted and yet chock full of good information that lets customers, employees, business partners, and suppliers feel like he's talking directly to them. They can use his blog to get first-hand information about a variety of issues facing the company, the industry, and the world in general. Some students will find the business use of blogs helpful while others may find them useless. Much of the value of business blogging is found in the content of the blog itself.

- 1. What is the name of the blog you selected?**
- 2. Who is the intended audience of this blog?**
- 3. What subjects does the blog address?**
- 4. Visit several more blogs in Sun's directory. If you were a Sun employee, do you think you would find these blogs helpful? Why or why not? Do you think there is value in blog entries that discuss the author's personal life instead of work-related matters?**

15.3 KNOWLEDGE WORK SYSTEMS

Many of the systems we've discussed centered on how to collect, store, distribute, and apply knowledge. This section talks about how to create knowledge.

KNOWLEDGE WORKERS AND KNOWLEDGE WORK

We're all pretty familiar with *office systems* that secretaries, clerical workers, and some professionals use. In fact, you've probably used some of the same applications contained in an office system. The most popular is the Microsoft Office suite, which includes word processing (Word), personal information management systems (Outlook), spreadsheets (Excel), and database software (Access). Office systems help disseminate and coordinate the flow of information, *both* internally and externally to the organization.

Knowledge work systems, on the other hand, support the creation and integration of new knowledge that is beneficial to the organization. KWS are often used by and support professional employees such as engineers, researchers, analysts, and highly skilled technical workers. They are connected to knowledge systems that provide information others have discovered to be successful solutions or best practices. The organizational memory we spoke of earlier is shared among other workers more efficiently with knowledge systems.

REQUIREMENTS OF KNOWLEDGE WORK SYSTEMS

The first requirement of a KWS is that it provides knowledge workers with the following necessary tools:

- Graphics tools
- Analytical tools
- Communication tools
- Document management tools
- User friendly interfaces

EXAMPLES OF KNOWLEDGE WORK SYSTEMS

Pick up any business or technology magazine, or watch the news channels and you'll find numerous examples of how companies are using knowledge work systems to re-create their core processes, create new products or services, or improve old ones.

Computer-aided design (CAD) applications are used by design engineers to build new products or improve old ones. It used to take three to four years and millions of dollars to design a new car. With improved CAD systems, automobile manufacturers have reduced the time to 18–24 months and cut the cost by millions of dollars.

Virtual reality systems have sophisticated imagery that makes you feel like you're "right there!" You may have seen this system on TV shows or in the movies. You're usually required to wear special equipment that feeds your reactions back to the computer so that it can plan its responses to your input. The Canadian Air Force uses virtual reality systems to help train pilots.

VRML (Virtual Reality Modeling Language) is a set of specifications for interactive 3-D modeling on the Web. Many companies are putting their training systems right on the

Internet so that people can have access to the latest information and can use it when they need it. Some Web sites use Java applets to help process the programs on the local workstation.

How would you like to make investment decisions based on information that is 90 days old or older? Would you have very much faith in a system that told you *only* how the company did financially last year, or would you also like to know how the company performed last quarter? That's the idea behind **investment workstations**. They combine information about companies that is internal and external, new and old, in order to advise clients on the best use of their investment dollars. The amount of data is massive and must be processed quickly in order to keep up with the changing market conditions and the changing nature of the industries themselves.

Bottom Line: You can distinguish between office systems and knowledge work systems by the way they manage knowledge and information, and by the type of worker using them. Office systems are comprised of information processors, while KWS create and manage knowledge using computer aided design systems, virtual reality systems, and VRML. Information and knowledge are key business assets that must be nurtured, protected, grown, and managed for the benefit of the entire organization.

15.4 INTELLIGENT TECHNIQUES

Many people have the impression that **artificial intelligence (AI)** is all about computers taking over the world and turning on their human inventors. That's not true; they can't replace humans. Many of the systems under the AI umbrella are useful tools for capturing, storing, and disseminating human knowledge and intelligence. Other AI systems are used for **knowledge discovery**.

CAPTURING KNOWLEDGE: EXPERT SYSTEMS

Expert systems are a common form of artificial intelligence. They are used to *assist* humans in the decision-making process, but they don't *replace* humans. Many of the decisions we make are based on past experience, but we have the added benefit of reasoning and intuition. Expert systems ask questions, then give you advice and reasons why you should take a certain course of action based on hard data, not on hunches. Again, they don't make the final decision.

Most of the problems an expert system helps resolve can, in fact, be solved by a human. But since the computer is faster or safer, businesses choose to use them instead of a person.

How Expert Systems Work

Expert systems rely on a **knowledge base** built by humans based on their experiences and knowledge. The base requires rules and knowledge frames in which it can process data. When you think about it, humans work the same way. You look out the window to see if it's raining. *If* it is, *then* you grab your umbrella. *If* it's not raining, *then* you don't. There you have it, a rule base.

The strategy used to search through a knowledge base is called the **inference engine**. Two strategies are commonly used: forward chaining and backward chaining.

In our example, using a **forward chaining** inference engine, you would start with the idea that it's raining. You'd move through a series of decisions until you reached a conclusion and acted on it. You would determine that it's raining, then you'd decide how much, then you'd decide how wet you don't want to be, then you'd decide to take an umbrella. As long as the answer continues to be yes, you keep moving forward.

In a **backward chaining** inference engine, you'd start with a hypothesis and work backward until your hypothesis is proved or disproved. You got wet because it was raining; using an umbrella would prevent that.

You build an expert system in a similar fashion as other information systems in terms of hardware and software. However, it's even more important to continually maintain and update an expert system: You never want to make decisions based on outdated or incorrect information. You can build a transaction processing system and perhaps not update it for six months to a year. With an expert system, you have to update the data and the processing software almost immediately and continually so that it's never out of date.

A **knowledge engineer** is especially adept at pulling information from various sources, including humans, and making sure it fits into the expert system. The hardest part of the job may be convincing people to offer up their expertise and knowledge that can be incorporated in the system.

Examples of Successful Expert Systems

You measure the success of an expert system by the following:

- Reduced errors
- Reduced cost, reduced training time
- Improved decisions
- Improved quality and services
- Happy users and happy customers

Most problems solved by expert systems are mundane situations. "If it's raining, then take an umbrella." But what happens if it's cloudy and only "looks" like it will rain? Expert systems only do well in situations in which there are definitive outcomes. They aren't good at making decisions based on inferences. The expert system might *advise* to take the umbrella along or to leave it home based on the input. The human makes the final decision to take or leave the umbrella.

If you understand that expert systems can only do so much, you'll be just fine. If you understand that they aren't people with the powers of reasoning and intuition, and therefore they can't make every decision, you'll know when to override the system and when to go with its output. Remember that everything in an expert system is based on IF this, THEN that. We know not everything is black and white and there are many gray areas.

Expert systems should not replace managers. They can aid managers in the decision-making process, but managers have to make the final call.

ORGANIZATIONAL INTELLIGENCE: CASE-BASED REASONING

So far, we've concentrated on capturing the individual knowledge in an expert system. Through practical experience, you've realized that "two heads are better than one." Very seldom will only one individual work on a project. Or perhaps one individual works on the candy bar ad campaign while another works on the breakfast cereal campaign. They have different and yet similar experiences. What if you could tap into each person's experience and knowledge on a collective basis? Take the best of the best from each one and apply it to your needs. Then you give your knowledge to someone else who will combine it with knowledge from others and continue building on "the best of the best." That's what a **case-based reasoning (CBR)** system does best.

The Help files you find in most desktop software applications are built on a case-based reasoning model. The technical support staff combines thousands of customer queries into a single database of problems and solutions and refines that information into a series of IF this is the problem, THEN try this. Access the Help files in your desktop software and try it.

FUZZY LOGIC SYSTEMS

Okay, one more time, back to our umbrella. If it's only cloudy outside, how do you know whether to take the umbrella? "It depends on how cloudy it is," you say. If *looks* like rain, you know to take the umbrella; there is a strong possibility that it will pour buckets. If it's only a little cloudy and doesn't *look* like rain, you'll take the chance that you won't get wet and leave the umbrella at home. That's fuzzy logic!

Fuzzy logic, a relatively new rule-based advance in AI, is based on approximate values and ambiguous data. A fuzzy logic system will combine various data into a range of possibilities and then help solve problems that we couldn't solve before with computers.

NEURAL NETWORKS

This type of knowledge system is as close to emulating the human ability to learn as we've been able to come. Let's return to our umbrella example. How do you know to take an umbrella when it's raining? You probably got wet a few times without one. Then

you tried using one when it rained and discovered that you didn't get wet. You *learned* that when it rains, an umbrella will keep you dry. That's basically how **neural networks** work.

You give a neural network data for which you already know the output, so that it has a base of correct information upon which it can build. When you give it new, different data, the computer will compare it with the previous data to determine what the correct outcome of the situation should be. If the data don't fit, it figures out why. It adds that information to its current database of knowledge and then keeps taking in more data. It eventually *learns* the right outcome. The more data it takes in, and the more situations it gets right, the better it becomes at knowing the right answer to the next set of decisions.

The Difference between Neural Networks and Expert Systems:

- Expert systems *emulate* human decision making.
 - Neural networks *learn* human thought processes and reasoning patterns.
- Expert systems use rules and frames in which to make their decisions.
 - Neural networks adjust to inputs and outputs.
- Expert systems require humans to update their database of information.
 - Neural networks continue to expand their own base of information.

GENETIC ALGORITHMS

We've evolved as a human race through genetics. We are made up of many combinations of generations of humans. That's how **genetic algorithms** work. Solutions to problems are examined by the system. The best solution is retained for future use, while the worst solutions are discarded. The solutions that are retained are used to help provide better solutions to future problems. They are combined and changed the next time they are used.

Businesses often need to solve problems that are dynamic, complex, and have many variables. Very few problems are clear-cut, black-and-white. Genetic algorithms are good systems for businesses to use because it's almost like having millions of people coming at a problem from all directions.

HYBRID AI SYSTEMS

We've mentioned before about taking the best of the best and that's just what **hybrid AI systems** are. They take the best parts of genetic algorithms, and the best parts of expert systems, and the best parts of fuzzy logic, and the best parts of neural networks, and combine them into one system that solves the problem. You can look forward to more of this hybridization as we continue to expand our knowledge of technology and of human behaviour.

INTELLIGENT AGENTS

Jump on the Web and find the best price for computer printer supplies. Simply typing the words “computer printer supplies” into your favourite search engine will result in thousands of pages with more than just price information. You can find specific information on prices much faster using an **intelligent agent**. These software programs learn your personal preferences for accomplishing simple tasks and can take the drudgery out of repetitive, specific work. Figure 15-14 in the text demonstrates intelligent agent technology at work.

Businesses can use intelligent agents to help train users on new systems, schedule appointments, or monitor work in progress. By far though, the most popular use of this nifty little software program is as a “shopping agent” that surfs the Web for you looking for specific items to purchase or the lowest prices on a particular item.

If you'd like to try a shopping bot yourself, try <http://www.mysimon.com/>. The Web site explains its service this way “Our secret is a team of helpers built with patent-pending software. The Virtual Learning Agent™ technology creates ‘intelligent agents’ trained by our own team of shopping experts to collect information from any online store.” It's fun and fast.

Agent-based modeling applications have been developed to model the behaviour of consumers, stock markets, and supply chains and to predict the spread of epidemics.

Bottom Line: Businesses are interested in artificial intelligence to preserve the intelligence and knowledge of their employees and use it to their competitive advantage. Expert systems emulate humans in the decision-making process but cannot replicate the intuition and reasoning that still require the human touch. Many new technologies can help humans solve difficult problems or take advantage of new opportunities. Neural networks learn how to make decisions. Fuzzy logic uses “ranges of possibilities” instead of giving black-and-white, yes-no answers. Intelligent agents take much of the drudgery out of searching dozens of Web sites.

WINDOW ON TECHNOLOGY: SHARING KNOWLEDGE WITH SOCIAL BOOKMARKING

The Window on Technology describes how social bookmarking works and discusses how its benefits can be used for knowledge management. Social bookmarking sites are a popular way to store, classify, share and search links through the practice of “folksonomy” techniques on the Internet or intranet.

TO THINK ABOUT QUESTIONS

1. What are the advantages and disadvantages of using social bookmarking for knowledge management?

Social bookmarking has several advantages over traditional automated resource location and classification software.

- Bookmarks are stored on shared sites where they can be accessed from any location with Web access and also shared with other people.
- Shared bookmark sites can be sites for bookmarking pages on the public Web or internal corporate sites for bookmarking pages on the corporate intranet.
- Bookmarks are “tagged” with keywords to help organize and classify them.
- Other people can use these tags to find bookmarks relevant to their interests that may help them find information more easily, including new sources of information that might be missed by search engines.
- Social bookmarking sites indicate the author of each bookmark and provide access to that person’s other bookmarked resources.
- Users can make social connections with other individuals interested in a particular topic.
- Allows like-minded individuals to find one another and create new communities of users.
- Visitors to social bookmarking sites can search for resources by keyword, person, or popularity and see the public bookmarks, tags, and classification schemes that registered bookmark users have created.
- All tag-based classification of Internet resources is done by human beings, who understand the content of the resource, as opposed to software that algorithmically attempts to determine the meaning of a resource (source: wikipedia.org).
- As people bookmark resources that they find useful, resources that are of more use are bookmarked by users. Thus, such a system will “rank” a resource based on its perceived utility (source: wikipedia.org).

Social bookmarking has several disadvantages as well:

- Reflects the values of a community of users that could result in a skewed view of a particular topic.
- No standard set of keywords (source: wikipedia.org).
- No standard for the structure of tags (e.g. singular vs. plural, capitalization, etc.). (source: wikipedia.org).
- Mistagging due to spelling errors (source: wikipedia.org).
- Tags that can have more than one meaning (source: wikipedia.org).
- Unclear tags due to synonym/antonym confusion (source: wikipedia.org).
- Highly unorthodox and “personalized” tag schemas from some users (source: wikipedia.org).
- No mechanism for users to indicate hierarchical relationships between tags (e.g. a site might be labeled as both *cheese* and *cheddar*, with no mechanism that might indicate that *cheddar* is a refinement or sub-class of cheese (source: wikipedia.org)).

- Social bookmarking can also be susceptible to corruption and collusion (source: wikipedia.org).

2. What management, organization, and technology issues should be addressed when considering whether to use social bookmarking for knowledge management at a business?

Some of the disadvantages listed in the first question can be expanded upon in answer this question. In a social bookmarking system, users store lists of Internet resources, which they find useful. These lists are both accessible to the public or a specific network, and other people with similar interests can view the links by category, tags, or even randomly. Some allow for privacy on a per-bookmark basis. There are many reasons why a business might wish to use this technology however, it is imperative that they keep in mind the pitfalls associated with it. Privacy of information must be given close attention. Corporations want to protect their knowledge resource and ensure that these “islands of information” are kept secure from unauthorized individuals. Social bookmarking involves storing data in yet another location that must be maintained and updated.

The technology behind social bookmarking is not complex, which means the threshold to participate is low, both for Web sites offering such services and for users. Social bookmarking is being built into other applications. The practice of tagging information is being extended to other types of resources, such as multimedia files and e-mail. This shift away from formal taxonomies may have important implications for how user communities are born and how they function. As the landscape for online resources changes and new systems of classifying those resources emerge and mature, the design and function of databases themselves may ultimately be changed to accommodate new ways of managing information (source: <http://www.educause.edu/ir/library/pdf/ELI7001.pdf>).

3. Should there be different standards for posting bookmarks to public Web pages at a public Web site and posting bookmarks to internal corporate Web pages on a corporate social bookmarking site?

This is a complex question to answer. Clearly, the disadvantages listed in the previous question will indicate that social bookmarking must be used with caution. On the surface it would appear that there would be a genuine benefit to use different standards for public bookmarks and bookmarks used for internal corporate Web pages.

Social bookmarking opens the door to new ways of organizing information and categorizing resources. The creator of the bookmark assigns tags to each resource, resulting in a user-directed, “amateur” method of classifying information. The downside is that these “like-minded” individuals may simply be posting their personal views rather than those based on proven facts.

MIS IN ACTION QUESTIONS

Visit the social bookmarking site Del.icio.us (<http://del.icio.us/>) and search for bookmarks on a topic of your choice, such as global warming, bird flu, ethanol, or open-source. Then answer the following questions:

1. How easy was it to find bookmarks about your topic? How many bookmarks did you find?
2. Compare these bookmarks to the results of a search on your topic of choice using Google, Yahoo!, or another search engine. Which tools were the most useful in pointing you to good information?
3. Would you use Del.icio.us to find information for a research paper or business presentation? Why or why not?

The following Web link is an excellent site that students can utilize in completing this question.

<http://www.aboutsocialbookmarks.com/asb/DisplayArticleServlet/DirectorySocialBookmarkingSites.html>

SUMMARY

1. *What is the role of knowledge management and knowledge management programs in business?*

Knowledge management is a set of processes to create, store, transfer, and apply knowledge in the organization. Businesses need knowledge management programs because knowledge has become a central productive and strategic asset in today's information economy and a potential source of competitive advantage. Much of a firm's value depends on its ability to create and manage knowledge. Knowledge management promotes organizational learning by increasing the ability of the organization to learn from its environment and to incorporate knowledge into its business processes. Effective knowledge management systems require organizational and management capital to promote a knowledge culture and programs for knowledge management, including the creation of a chief knowledge officer. There are three major types of knowledge management systems: enterprise-wide knowledge management systems, knowledge work systems, and intelligent techniques.

2. *What types of systems are used for enterprise-wide knowledge management, and how do they provide value for businesses?*

Enterprise-wide knowledge management systems are firmwide efforts to collect, store, distribute, and apply digital content and knowledge. Structured knowledge systems provide databases and tools for organizing and storing structured documents, whereas semi structured knowledge systems provide databases and tools for

organizing and storing semi structured knowledge, such as e-mail or rich media. Knowledge network systems provide directories and tools for locating firm employees with special expertise who are important sources of tacit knowledge. Often these systems include group collaboration tools (including wikis and social bookmarking), portals to simplify information access, search tools, and tools for classifying information based on a taxonomy that is appropriate for the organization. Enterprise-wide knowledge management systems can provide considerable value if they are well designed and enable employees to locate, share, and use knowledge more efficiently.

3. *What are the major types of knowledge work systems, and how do they provide value for firms?*

Knowledge work systems (KWS) support the creation of new knowledge and its integration into the organization. KWS require easy access to an external knowledge base; powerful computer hardware that can support software with intensive graphics, analysis, document management, and communications capabilities; and a user-friendly interface. These capabilities can increase the productivity of highly paid knowledge workers. KWS often run on workstations that are customized for the work they must perform. Computer-aided design (CAD) systems and virtual reality systems, which create interactive simulations that behave like the real world, require graphics and powerful modeling capabilities. KWS for financial professionals provide access to external databases and the ability to analyze massive amounts of financial data very quickly.

4. *What are the business benefits of using intelligent techniques for knowledge management?*

Artificial intelligence lacks the flexibility, breadth, and generality of human intelligence, but it can be used to capture, codify, and extend organizational knowledge. Businesses can use artificial intelligence to help them capture and preserve tacit knowledge; for knowledge discovery; to generate solutions to specific problems that are too massive and complex to be analyzed by human beings on their own; and to help firms search for and filter information.

Expert systems capture tacit knowledge from a limited domain of human expertise and express that knowledge in the form of rules. The strategy to search through the knowledge base, called the inference engine, can use either forward or backward chaining. Expert systems are most useful for problems of classification or diagnosis. Case-based reasoning represents organizational knowledge as a database of cases that can be continually expanded and refined. When the user encounters a new case, the system searches for similar cases, finds the closest fit, and applies the solutions of the old case to the new case. The new case is stored with successful solutions in the case database.

Fuzzy logic is a software technology for expressing knowledge in the form of rules that use approximate or subjective values. Fuzzy logic has been used for controlling physical devices and is starting to be used for limited decision-making applications.

Neural networks consist of hardware and software that attempt to mimic the thought processes of the human brain. Neural networks are notable for their ability to learn and to recognize patterns that cannot be easily described by humans. They are being used in science, medicine, and business primarily to discriminate patterns in massive amounts of data.

Genetic algorithms develop solutions to particular problems using genetically based processes such as fitness, crossover, and mutation. Genetic algorithms are beginning to be applied to problems involving optimization, product design, and monitoring industrial systems where many alternatives or variables must be evaluated to generate an optimal solution.

Intelligent agents are software programs with built-in or learned knowledge bases that carry out specific, repetitive, and predictable tasks for an individual user, business process, or software application. Intelligent agents can be programmed to navigate through large amounts of data to locate useful information and in some cases act on that information on behalf of the user.

KEY TERMS

Agent-based modeling — applications that have been designed to follow simple rules for interaction.

Artificial intelligence (AI) — the effort to develop computer-based systems that can behave like humans, with the ability to learn languages, accomplish physical tasks, use a perceptual apparatus, and emulate human expertise and decision making.

Backward chaining — a strategy for searching the rule base in an expert system that acts like a problem solver by beginning with the hypothesis and seeking out more information until the hypothesis is either proved or disproved.

Case-based reasoning (CBR) — artificial intelligence technology that represents knowledge as a database of cases and solutions.

Chief knowledge officer (CKO) — senior manager in charge of the information systems function in the firm.

Communities of practice (COPS) — informal social networks of professionals and employees within and outside the firm who have similar work-related activities and interests.

Computer-aided design (CAD) — information system that automates the creation and revision of designs using sophisticated graphics software.

Data — streams of raw facts representing events occurring in organizations or the physical environment before they have been organized and arranged into a form that people can understand and use.

Expert systems — knowledge-intensive computer program that captures the expertise of a human in limited domains of knowledge.

Explicit knowledge — knowledge that has been documented.

Forward chaining — a strategy for searching the rule in an expert system that begins with the information entered by the user and searches the rule base to arrive at a conclusion.

Fuzzy logic — rule-based artificial intelligence (AI) that tolerates imprecision by using nonspecific terms called membership functions to solve problems.

General algorithms — problem-solving methods that promote the evolution of solutions to specified problems using the model of living organisms adapting to their environment.

Hybrid AI systems — integration of multiple artificial intelligence (AI) technologies into a single application to take advantage of the best features of these technologies.

Inference engine — the strategy used to search through the rule base in an expertise system; can be forward or backward chaining.

Intelligent agent — software program that uses a built-in or learned knowledge base to carry out specific, repetitive, and predictable tasks for an individual user, business process, or software application.

Intelligence techniques — technologies that aid decision makers by capturing individual and collective knowledge, discovering patterns and behaviours in very large quantities of data, and generating solutions to problems that are too large and complex for human beings to solve on their own.

Investment workstations — powerful desktop computer for financial specialists that is optimized to access and manipulate massive amounts of financial data.

Knowledge — concepts, experience, and insight that provide a framework for creating, evaluating, and using information.

Knowledge base — model of human knowledge that is used by expert systems.

Knowledge discovery — identification of novel and valuable patterns in large databases.

Knowledge engineer — a specialist who elicits information and expertise from other professionals and translates it into a set of rules, or frames, for an expert system.

Knowledge management — the set of processes developed in an organization to create, gather, store, maintain, and disseminate the firm's knowledge.

Knowledge network systems — online directory for locating corporate experts in well-defined domains.

Knowledge repository — collection of documented internal and external knowledge in a single location for more efficient management and utilization by the organization.

Knowledge work systems (KWS) — information systems that aid knowledge workers in the creation and integration of new knowledge in the organization.

Learning management systems (LMS) — tools for the management, delivery, tracking, and assessment of various types of employee learning.

Neural networks — hardware or software that attempts to emulate the processing patterns of the biological brain.

Organizational learning — creation of new standard operating procedures and business processes that reflect organization's experience.

Semi structured knowledge — information in the form of less structured objects, such as e-mail, chat room exchanges, videos, graphics, brochures, or bulletin boards.

Semi structured knowledge systems — system for organizing and storing less structured information, such as e-mail, voice mail, videos, graphics, brochures or bulletin boards. Also known as digital asset management system.

Social bookmarking — make it easy to search for, and share information by allowing users to save their bookmarks to Web pages on a public Web site and tag these bookmarks with keywords.

Structured knowledge — knowledge in the form of structured documents and reports.

Structured knowledge systems — system for organizing structured knowledge in a repository where it can be accessed throughout the organization. Also known as content management system.

Tactic knowledge — expertise and experience of organizational members that have not been formally documented.

Taxonomy — method of classifying things according to a predetermined system.

Virtual Reality Modeling Language (VRML) — a set of specifications for interactive three-dimensional modeling on the World Wide Web.

Virtual reality systems — interactive graphics software and hardware that create computer-generated simulations that provide sensations that emulate real-world activities.

Wisdom — the collective and individual experience of applying knowledge to the solution of problems.

REVIEW QUESTIONS

1. What is the role of knowledge management and knowledge management programs in business?

Define knowledge management and explain its value to businesses.

Knowledge management is the set of processes developed in an organization to create, gather, store, maintain, transfer, apply, and disseminate the firm's knowledge. Knowledge management promotes organizational learning and incorporates knowledge into its business processes and decision making. As the textbook points out, knowledge management enables the organization to learn from its environment and incorporate this new knowledge into its business processes. Knowledge management helps firms do things more effectively and efficiently, and cannot be easily duplicated by other organizations. This "in-house" knowledge is a very valuable asset and is a major source of profit and competitive advantage

Describe the important dimensions of knowledge.

Table 15-1 describes the important dimensions of knowledge:

- **Knowledge is a firm asset:** an intangible asset; requires organizational resources; experiences network effects as its value increases as more people share it.
- **Knowledge has different forms:** can be either tacit or explicit; involves know-how, craft, and skill; involves knowing how to follow procedures; involves knowing why, not simply when, things happen.
- **Knowledge has a location:** it's a cognitive event involving mental models and maps of individuals; has both a social and an individual basis of knowledge; is "sticky, situated, and contextual.
- **Knowledge is situational:** it's conditional; it's related to context.

Distinguish between data, knowledge, and wisdom and between tacit knowledge and explicit knowledge.

Data by itself has no meaning but is the first step in the creation of knowledge. **Knowledge** includes concepts, experience, and insight that provide a framework for creating, evaluating, and using information. **Wisdom** is the collective and individual experience of applying knowledge to the solution of problems. **Explicit knowledge** is knowledge that has been documented whereas **tacit knowledge** is the expertise and experience of organizational members that has not been formally documented

Describe the stages in the knowledge management value chain.

Refer to Figure 15–2 for the knowledge management value chain. These steps include:

- **Acquire:** knowledge discovery, data mining, neural networks, genetic algorithms, knowledge workstations, expert knowledge networks
- **Store:** document management systems, knowledge databases, expert systems
- **Disseminate:** intranet portals, push e-mail reports, search engines, collaboration
- **Apply:** decision support systems, enterprise applications

2. What types of systems are used for enterprise-wide knowledge management and how do they provide value for businesses?

Define and describe the various types of enterprise-wide knowledge management systems and explain how they provide value for businesses.

There are three types of knowledge management systems:

- **Enterprise-wide knowledge management systems** are general-purpose, firmwide efforts that collect, store, distribute, and apply digital content and knowledge. These systems include capabilities for searching for information, storing both structured and unstructured data, and locating employee expertise within the firm. They also include supporting technologies such as portals, search engines, collaboration tools, and learning management systems. Structured knowledge systems provide databases and tools for organizing and storing structured documents, whereas semi structured knowledge systems provide databases and tools for organizing and storing semi structured knowledge, such as e-mail or rich media.
- **Knowledge network systems** provide an online directory of corporate experts in well-defined knowledge domains and use communication technologies to make it easy for employees to find the appropriate expert in a company. Some knowledge network systems go further by systematizing the solutions developed by experts and then storing the solutions in a knowledge database as a best-practices or frequently asked questions (FAQ) repository. Often these systems include group collaboration tools, portals to simplify information access, search tools, and tools for classifying information based on a taxonomy that is appropriate for the organization.
- **Intelligent techniques** help discover patterns and apply knowledge to discrete decisions and knowledge domains. It uses tools like data mining, neural

networks, experts systems, case-based reasoning, fuzzy logic, genetic algorithms, and intelligent agents (bots) to capture individual and collective knowledge and to extend their knowledge base.

Describe the role of the following in facilitating knowledge management: portals, wikis, social bookmarking, and learning management systems.

- **Portals** provide access to external sources of information like news feeds and research, as well as to internal knowledge resources along with capabilities for e-mail, chat/instant messaging, discussion groups, and videoconferencing.
- **Wikis** provide a central repository for all types of corporate data that can be displayed in a Web browser, including electronic pages of documents, spreadsheets, and electronic slides. They can embed e-mail and instant messages. Even if wikis are changed, the software tracks the changes and provides tools for reverting to earlier versions.
- **Social bookmarking** lets users save bookmarks to Web pages on a public Web site and tag these bookmarks with keywords. The bookmarks can be shared with co-workers, managers, customers, suppliers, and business partners.
- **Learning management systems** provide tools for the management, delivery, tracking, and assessment of various types of employee learning. These systems provide value to the business by reducing the time and cost to acquire and utilize knowledge and by providing knowledge for higher-quality decisions

3. What are the major types of knowledge work systems, and how do they provide value for firms?

Define knowledge work systems and describe the generic requirements of knowledge work systems.

Knowledge work systems (KWS) are specialized systems for engineers, scientists, and other knowledge workers that are designed to promote the creation of knowledge and to ensure that new knowledge and technical expertise are properly integrated into the business. These systems reflect the special needs of knowledge workers. In this day and age, knowledge work is critical to most organizations, and in some organizations knowledge work systems produce strategic advantage or the knowledge that enables their company to keep up with others who are trying for strategic advantages.

KWS must have adequate computing power to handle the specialized tasks and complex calculations, provide easy access to external databases to support research, and present a user-friendly interface. KWS software uses intensive graphics, analysis, document management, and communications capabilities. These capabilities can increase the productivity of highly paid knowledge workers. KWS often run on workstations that are customized for the work they must perform. Computer-aided design (CAD) systems and virtual reality systems, which create interactive simulations that behave like the real world, require graphics and powerful

modeling capabilities. KWS for financial professionals provide access to external databases and the ability to analyze massive amounts of financial data very quickly.

Describe how the following systems support knowledge work: CAD, virtual reality, and investment workstations.

- CAD systems automate the creation and revision of designs using computers and sophisticated graphics software. Benefits include the production of more sophisticated and functional designs, reducing the time required to produce designs, reducing expensive engineering changes, preparing fewer prototypes, and facilitating the tooling and manufacturing process.
- Virtual reality systems have visualization, rendering, and simulation capabilities. Virtual reality systems use interactive graphics software to create computer-generated simulations that are so close to reality that users believe they are participating in a real world. The users actually feel immersed in the computer-generated world. Virtual reality is providing educational, scientific, and business benefits.
- Investment workstations are computer systems that access and manipulate massive amounts of financial data to manage financial trades and portfolio management. In addition to massive amounts of data, financial data are produced so quickly that specialized, very powerful systems are necessary to keep up with the rapid speed of finance and financial changes.

4. What are the business benefits of using intelligent techniques for knowledge management?

Define an expert system, describe how it works, and explain its value to business.

Expert systems are an intelligent technique for capturing tacit knowledge in a very specific and limited domain of human expertise. These systems capture the knowledge of skilled employees in the form of a set of rules in a software system that can be used by others in the organization.

Expert systems model human knowledge as a set of rules that collectively are called the knowledge base. The strategy used to search through the collection of rules and formulate conclusions is called the inference engine. The inference engine works by searching through the rules and “firing” those rules that are triggered by facts gathered and entered by the user.

Expert systems help organizations make high-quality decisions with fewer people. They are used in discrete, highly structured, decision-making situations where expertise is expensive or in short supply.

Define case-based reasoning and explain how it differs from an expert system.

Case-based reasoning (CBR) uses descriptions of past experiences of human specialists, representing them as “cases” and storing them in a database for later retrieval when the user encounters a new case with similar parameters. The system searches for stored cases similar to the new one, locates the closest fit, and offers the solution to the old case for use with the new case. If the new case fits the solution, it is added to the case database. If not, the case will be added with a new solution or explanations as to why the solution did not work. CBR differs from expert systems in that it captures the knowledge of the organization rather than a single expert, and the knowledge is captured as cases rather than if-then rules. Also, expert systems work by applying IF-THEN-ELSE rules against a knowledge base whereas CBR represents knowledge as a series of cases. With case-based reasoning, the knowledge base is continuously updated by the users.

Define a neural network and describe how it works and how it benefits businesses.

Neural networks are usually physical devices (although they can be simulated with software) that emulate the physiology of animal brains. Neural networks are used for solving complex, poorly understood problems for which large amounts of data have been collected. They find patterns and relationships in massive amounts of data that would be too complicated and difficult for a human being to analyze. Neural networks “learn” patterns from large quantities of data by sifting through data, searching for relationships, building models, and correcting over and over again the model's own mistakes.

In a neural network, the resistors in the circuits are variable, and can be used to teach the network. When the network makes a mistake, i.e., chooses the wrong pathway through the network and arrives at a false conclusion, resistance can be raised on some circuits, forcing other neurons to fire. Used after a false conclusion, intervention teaches the machine the correct response. If this learning process continues for thousands of cycles, the machine learns the correct response. The simple neurons or switches are highly interconnected and operate in parallel so they can all work simultaneously on parts of a problem. Neural networks are very different from expert systems where human expertise has to be modeled with rules and frames. In neural networks, the physical machine emulates a human brain and can be taught from experience.

Define and describe fuzzy logic, genetic algorithms, and intelligent agents. Explain how each works and the kinds of problems for which each is suited.

Fuzzy logic is a rule-based AI technology that tolerates imprecision by creating rules that use approximate or subjective values and incomplete or ambiguous data. Fuzzy logic represents more closely the way people actually think than traditional IF-THEN rules. For example, if we all agree that 120 degrees is hot and -40 degrees is cold, then is 75 degrees hot, warm, comfortable, or cool? The answer is fuzzy at best and

cannot be programmed in an IF-THEN manner. Japan's Sendai subway system uses a fuzzy logic system to control acceleration so it will operate more smoothly.

Genetic algorithms (adaptive computation) are a variety of problem-solving methods that are conceptually based on the method that living organisms use to adapt to their environment (process of evolution.) Genetic algorithms control the generation, variation, adaptation, and selection of possible problem solutions using genetically-based processes. As solutions alter and combine, the worst ones are discarded and the better ones survive to go on and produce even better solutions. Genetic algorithms are particularly suited to the areas of optimization, product design, and the monitoring of industrial systems. Organizations can use genetic algorithms to minimize costs and maximize profits and schedule and use resources efficiently. Genetic algorithms are ideal when problems are dynamic and complex and involve hundreds of variables or formulas. For example, General Electric used a genetic algorithm to help them design a jet turbine aircraft engine that required the use of about 100 variables and 50 constraint equations.

Intelligent agents are software programs that use a built-in or learned knowledge base to carry out specific, repetitive tasks for an individual user, business process, or software application. By watching the user of a program or system, an intelligent agent may customize the software system to meet the user's needs, reducing software support costs. Intelligent agents can be used as wizards to help users do or learn how to perform a given task. Intelligent agents can be used to carry out "smart" searches of the database, data warehouse, or the Internet, reducing search costs and avoiding the problems of misdirected searches. Agent-based modeling applications model consumer, stock market, and supply chain behaviour.

DISCUSSION QUESTIONS

1. Knowledge management is a business process, not a technology. Discuss.

Knowledge that cannot be communicated and shared with others is nearly useless. It becomes most useful and actionable when it's shared throughout an organization. Much of a company's value depends on its ability to create and manage knowledge. Well-executed knowledge-based projects have been known to produce extraordinary returns on investment. Knowledge management is a set of business processes used to create, store, transfer, and apply knowledge. It benefits from the usage of information technology to support these business processes. Information technology helps a company create, share, capture, codify, and distribute its knowledge.

2. Describe various ways that knowledge management systems could help firms with sales and marketing or with manufacturing and production.

KMS have been developed for sales and marketing to help them access and share information about customers, sales leads, competitors, and changes in pricing and specifications of products. Virtual Reality and VRML help customers experience the

look and feel of products before they purchase them, and case-based reasoning systems are used for customer service and support.

Manufacturing and production use knowledge work systems for creating and sharing product design and manufacturing specifications and for project management. Expert systems configure orders when many parts or features are being assembled. Experts systems and case-based reasoning are used for diagnostics and repairs. Fuzzy logic helps improve the performance of products and genetic algorithms help to solve problems in scheduling and design.

COLLABORATION AND TEAMWORK: RATING KNOWLEDGE NETWORK SYSTEMS

With a group of classmates, select two knowledge network systems products, such as AskMe Enterprise and Tacit ActiveNet™. Compare their features and capabilities. To prepare your analysis, use articles from computer magazines and the Web sites for the knowledge network software vendors. If possible, use Google Sites to prepare and present your findings to the class.

Responses will vary for this project and will depend on the sources of information students were able to research.

The purpose of this project is to visualize and understand the main features and capabilities of knowledge network systems and to understand how they might be used.

The Web sites for these companies are AskMe (www.askmecorp.com) and Tacit Knowledge Systems (<http://www.oracle.com/products/middleware/beehive/index.html>).

From AskMe's Web site:

“AskMe Enterprise is the most widely deployed solution for creating and managing Employee Knowledge Networks, and is used by some of the world's largest companies to improve speed and quality of execution. AskMe Enterprise has been successfully deployed by many of the world's largest companies across a wide range of industries. Our flexible solutions can be quickly deployed across your entire organization, or AskMe's Professional Services can help you target AskMe Enterprise to specific functions or processes in your company.

Using AskMe Enterprise in your Research and Development organization enables you to bring new products to market faster. AskMe helps drive innovation by ensuring the right expertise is delivered to researchers exactly when they need it.

Your employees need to communicate but organizational and geographical walls prevent them from doing so. By deploying AskMe for your entire company, you will break down those walls and enable your organization to act more efficiently. If you have already invested in corporate portals, document management solutions, or other systems and want to take them to the next level, AskMe for IT and Corporate Portals can help. With AskMe, you can dramatically increase the ROI of your portal and enhance the

functionality of your other IT investments.”

From Tacit Knowledge's Web site:

“Oracle has acquired the intellectual property assets of Tacit Software. Oracle has also hired all of the software engineers from Tacit Software. Tacit Software's unique automated profiling technology is an expertise location solution that helps organizations uncover new opportunities for collaboration. Oracle plans to integrate Tacit Software's technology into Oracle Beehive, a secure, integrated, standards-based enterprise collaboration platform.

The combined solution is expected to enable enterprises to make effective and immediate use of the knowledge present in their people, messaging and content.

Oracle Beehive delivers the only complete and open platform for secure communications and integrated collaboration. Oracle Beehive provides a complete range of collaboration services including conferencing, instant messaging, e-mail, calendar, and team workspaces that can be deployed either on premise or through Oracle On Demand. Its cross-platform, open standards based architecture supports familiar clients like Microsoft Outlook and can coexist with Microsoft Exchange. Oracle Beehive delivers the next generation of collaboration through an integrated user experience and unified administration that leverages the enterprise capabilities built into Oracle Fusion Middleware, Oracle Database, and Oracle Applications.

- **Secure Communications**—Full-featured Web conferencing, instant messaging, e-mail, calendar, and team workspaces based on a unified information model and centralized security
- **Integrated Collaboration**—Standards-based, hot-pluggable architecture enables organizations to embed collaboration tools into existing business applications and processes
- **Increased Security and Compliance**—Built-in security including verifiable deletion, auditing, policy management, and encryption
- **Lower Total Cost of Ownership**—Works with existing collaboration clients and servers on Windows, Linux, and Solaris platforms and can be deployed on premise or through Oracle On Demand”

LEARNING TRACK MODULE

Challenges of Knowledge Management Systems

Students will find a Learning Track Module on this topic at the MyMISLab for this chapter.

HANDS-ON MIS: PROJECTS

Management Decision Problems

1. U.S. Pharma Corporation: headquartered in New Jersey the company has research sites in Germany, France, U.K. Switzerland, and Australia. R& D is key to its ongoing profits. Researchers need to share information with others within and outside the company. Design a knowledge portal with design specifications relevant to internal systems and databases, external sources of information, and internal and external communication and collaboration tools. Design a home page for your portal.

Students will vary in their designs. Elements and principles they should address in the knowledge portal are ways to acquire, store, disseminate, and apply knowledge. The design should include capabilities for e-mail, chat/instant messaging, discussion groups, and videoconferencing. Web technologies like blogs, wikis, and social bookmarking/folksonomies should also be addressed. Security, access, and privacy might be included if you desire.

2. Sprint Nextel: has the highest rate of customer churn in the cell phone industry. Management wants to know why so many customers are leaving Sprint and what can be done to woo them back. How can the company use tools for online collaboration and communication to help find the answer? What management decisions could be made using information from these sources?

Knowledge acquisition is the key to answering management's questions. The company must create new knowledge by discovering patterns in corporate data. The data from the company's transaction processing system that track customer orders, payments, and service cancellations can provide part of the knowledge. Data from external sources like industry reports, government statistics, and industry metrics can also add to the knowledge base. Capturing and mining data from blogs, wikis, and social networking sites is another source of information. Managers can then decide to adjust pricing, offer special incentives to customers and employees, expand services, or change elements in promotional offers.

IMPROVING DECISION MAKING: BUILDING A SIMPLE EXPERT SYSTEM FOR RETIREMENT PLANNING

Software skills: Spreadsheet formulas and IF function or expert system tool

Business skills: Benefits eligibility determination

This problem is not well stated in the text. No bonus should be given when an employee has worked for five years or less and the system should be programmed to follow this rule.

Students will need to find an expert system tool that provides a mechanism, called the inference engine, which automatically matches facts against patterns and determines which rules are applicable.

Remind them about what “rules” the expert system is looking for: the “if” portion of a rule can actually be thought of as the “whenever” portion of a rule because pattern matching always occurs whenever changes are made to facts. The “then” portion of a rule is the set of actions to be executed when the rule is applicable. The actions of applicable rules are executed when the inference engine is instructed to begin execution. The inference engine selects a rule and then the actions of the selected rule are executed (which may affect the list of applicable rules by adding or removing facts). The inference engine then selects another rule and executes its actions. This process continues until no applicable rules remain.

If they want a good resource for their PDA, try <http://www.bitsys.demon.co.uk/download.htm>. This expert system for the palm is a trial version of the ZEN Expert System. The trial version is free to use but will only operate with the demonstration knowledge base.

Other sites to direct students to include:

- **PC AI — Expert systems resources**
- http://www.pcai.com/pcai/New_Home_Page/ai_info/expert_systems.html
This site hosts a brief introduction to expert systems and an extensive collection of links to expert system Web sites, vendors, articles, and references.

The solution requires a very simple system with a limited number of rules. If students can't find expert system software to work with, they can build a primitive system using spreadsheet software and the =IF function of Excel. Although Excel allows for a limited number of nested IF statements, the conditions tested are complex. The spreadsheet solution provided here implements each IF statement in a separate worksheet cell. The instructor may want to implement these rules in another way.

A simple formula page to calculate retirement planning can be found in the file named Ch15_Retirement_Solution.xls in the Chapter 15 folder.

IMPROVING DECISION MAKING: USING INTELLIGENT AGENTS FOR COMPARISON SHOPPING

Software skills: Web browser and shopping bot software

Business skills: Product evaluation and selection

You have decided to purchase a new digital camera. Select a digital camera you might want to purchase, such as the Canon PowerShot SD 950 or the Olympus Stylus 1200. To purchase the camera as inexpensively as possible, try several of the shopping bot sites which do the price comparisons for you. Visit My Simon (www.mysimon.com), BizRate.com (www.bizrate.com), and Google Product Search (<http://www.google.com/products>). Compare these shopping sites in terms of their ease of use, number of offerings, speed in obtaining information, thoroughness of

information offered about the product and seller, and price selection. Which site or sites would you use and why? How helpful were these sites for making your decision?

Students' answers will vary on which camera to purchase. The Canon seems to be rated higher on the various Web sites. Some of the reasons given are better usage, easier to find, lighter, a variety of options, good memory storage, and a better price. Some Web sites that students might go to in order to review the cameras are Digital Photography Review (www.dpreview.com), Digital Camera Resource Page (www.dcresource.com), Dcviews (www.dcvews.com), PCPhoto Review (www.pcphotoreview.com), and Megapixel (www.megapixel.com).

For the Web sites, MySimon and Google offer information on trying to purchase a digital camera, the different brands, rating scales based on stores, prices, seller options, and comparison shopping. BizRate has the fewest capabilities. It allows you to compare within the same brands but not between brands.

CASE STUDY: INNOVATION AND COLLABORATION AT COCA-COLA: IT'S THE REAL THING

1. Analyze Coca-Cola and its business strategy using the value chain and competitive forces models.

Coca-Cola's success is a result of its highly recognizable and trusted brand, often considered to be the most valuable brand in the world. The brand gives the company a large competitive advantage in the nonalcoholic beverage market. The competitive forces Coke faces include traditional competitors like Pepsico, new market entrants, substitute products and services, the power of customers to easily switch to competitor's products, and the market power of suppliers. To deal with these competitive forces, Coke is constantly trying to strengthen its customer and supplier intimacy and to differentiate its products. It uses information strategies to improve its primary and support activities. The company must continue to use its brands, its financial strength, its strong distribution system, and its global reach to remain competitive and foster growth.

2. What is the relationship of collaboration and knowledge management to Coca-Cola's business strategy?

The company focuses on innovation and collaboration with its customers, employees, and partners. It uses its information system to foster innovation and collaboration by using its digital asset management system to combat a growing amount of digital content that was scattered in an unorganized fashion causing employees to spend time searching for market demographics, sales figures, images, videos, and cultural information.

3. How is Coca-Cola using knowledge management systems to execute its business model and business strategy?

It created an online image library and digital archive containing images, documents, and videos, accessible by all employees via a standardized platform through the Web. It's largest bottling company, Coca-Cola Enterprises (CCE), began using Microsoft collaboration tools for ad hoc team collaboration and content management, Web conferencing, and unifying communications. Executives broadcast live video to all of the company's knowledge workers. Coke's Common Innovation Framework combines project management and business intelligence and is geared towards developing products and marketing them in a consistent and successful way across all of Coke's properties.

4. Why is Coca-Cola's relationship with its bottlers so important? What is Coke doing to improve its ability to collaborate with its bottlers?

Coke relies on independent, local bottlers (approximately 300 different companies) and has made significant investments in many of the companies. Coke's Project Scale was implemented to standardize the way Coke communicated with its bottlers and vice versa. The Coke One bottler model supports 650 business processes common to all bottlers. The program represents readily available intellectual property and provides the smaller bottler companies with opportunities for better deals, faster implementation of new processes, and higher capabilities.

5. What are Coca-Cola's prospects for success in the future? Will information systems make a difference? Why or why not?

Continual innovation will be necessary for future successes. The nonalcoholic beverage market is fast-moving, fad-driven, commodity-influenced, and difficult to control for very long. Knowledge management systems will help increase efficiencies in developing new products and in services and features that will reduce development costs. Coke is using social networks to market their products in innovative ways. Information systems will foster innovation and richer collaboration between employees, customers, and suppliers.