CHAPTER

11

Knowledge Management

LEARNING OBJECTIVES

1 Define knowledge and describe the different types of knowledge
2 Describe the characteristics of knowledge management
3 Describe organizational learning and its relationship to knowledge management
4 Describe the knowledge management cycle
5 Describe the technologies that can be used in a knowledge management system (KMS)
6 Describe different approaches to knowledge management
7 Describe the activities of the chief knowledge officer and others involved in knowledge management
8 Describe the role of knowledge management in organizational activities
9 Describe ways of evaluating intellectual capital in an organization
10 Describe how KMS are implemented
11 Describe the roles of people, process, and technology in knowledge management
12 Describe the benefits and drawbacks of knowledge management initiatives
13 Describe how knowledge management can revolutionize the way an organization functions

In this chapter, we describe the characteristics and concepts of knowledge management. In addition, we explain how firms use information technology (IT) to implement KM systems and how these systems are transforming modern organizations. Knowledge management, although conceptually ancient, is a relatively new business philosophy. The goal of knowledge management is to identify, capture, store, maintain, and deliver useful knowledge in a meaningful form to anyone who needs it, anyplace and anytime, within an organization. Knowledge management is about sharing and collaborating at the organization level. Knowledge management has the potential to revolutionize the way we share expertise, make decisions, and conduct business, as discussed in the following sections:

11.1 Opening Vignette: MITRE Knows What It Knows Through Knowledge Management
11.2 Introduction to Knowledge Management
11.3 Organizational Learning and Transformation

11.4 Knowledge Management Activities
11.5 Approaches to Knowledge Management
11.6 Information Technology (IT) in Knowledge Management
11.7 Knowledge Management Systems Implementation
11.8 Roles of People in Knowledge Management
11.9 Ensuring the Success of Knowledge Management Efforts

11.1 OPENING VIGNETTE: MITRE KNOWS WHAT IT KNOWS THROUGH KNOWLEDGE MANAGEMENT

Since knowledge management (KM) first bubbled up in the mid-1990s, many organizations have tried and failed to reap its benefits. Certain enterprises never gave up on the promise of KM. MITRE, operator of three federally funded research and development centers, is one of them. Starting with the MITRE's Information Infrastructure (MII) project in 1996, over the past 13 years it has built a comprehensive KM environment through experimentation and internal sponsorship. The company fosters a knowledge-sharing culture to bring its extensive expertise to bear on customer needs.

The MITRE Corporation was founded in 1958 to address the government's need to create the Semi-Automated Ground Environment (SAGE), an integrated system to defend the United States against the threat of Soviet air attacks. Since then, MITRE has been serving as an objective, nonprofit corporation whose mission is to serve U.S. interests by creating solutions to pervasive, cross-organizational problems facing the federal government in civil aviation, tax administration, and national security. Its mission statement reads: "As a public interest company, in partnership with the government, MITRE addresses issues of critical national importance, combining systems engineering and information technology to develop innovative, viable solutions that make a difference." Frequently, this means enabling innovation, integration, and collaboration within and across public sector agencies, requiring efficient and effective knowledge management.

Problem

MITRE has more than 6,000 employees distributed globally (principally throughout the United States but extending to Europe and the Far East) and includes both technical and mission or operational experts. With 60 percent of its employees having more than 20 years of experience and approximately two-thirds having advanced degrees, leveraging expertise is imperative. MITRE has extensive human assets who often are in positions as trusted advisors to the U.S. government. Regular interaction among technical and domain experts distributed throughout headquarters and sponsor-collocated units enables rapid and high-quality creation of "solutions that make a difference."

It is common for large, knowledge-intensive corporations to develop a culture of silos, each with its own pocket of knowledge. Over time, these silos start to function like rivals, compromising an organization's abilities. This is what MITRE was experiencing that led to the MII initiative in 1996. The main challenge for MITRE was to create an environment so that staff could tap each others' experience to address the requirements of a large number of complex research projects. In addition, demand for MITRE's services continued to increase in size and complexity, while its budget stayed relatively the same. MITRE had to find a way to eliminate the barriers between the knowledge pockets and leverage its knowledge assets to the fullest. MITRE had to develop into a *culture of sharing*.

Solution

As an early attempt at knowledge management, MII was implemented and released to the corporation in 1996. The central element of the system was the knowledge locator (a phonebook-like functionality that pulls together extensive information about the knowledge-workers and makes them available in a single Web page). Since then, MITRE has been experimenting with a number of knowledge management initiatives.

Figure 11.1 illustrates a comprehensive approach to knowledge management (similar to the one adopted at MITRE), which can be viewed as integrating strategies, processes, and technologies that enable the enterprise to acquire, create, share, and make actionable knowledge needed to achieve its mission. As Figure 11.1 illustrates, core knowledge management processes such as the creation, sharing, and application of knowledge are performed within the context of corporate

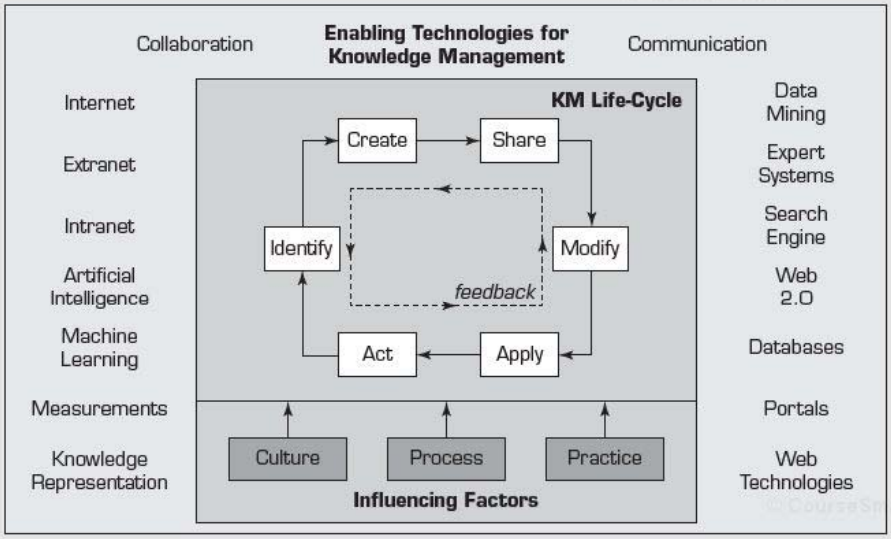

FIGURE 11.1 MITRE's Holistic Approach to Knowledge Management *Source:* Mark T. Maybury, "Knowledge Management at the MITRE Corporation," 2003, **mitre.org/ work/tech_papers/ tech_papers_03/maybury_knowledge/KM_MITRE.pdf** (accessed June 2009).

processes, practices, and culture. They are supported by a number of enabling technologies, such as intranets, information push/pull, data mining, expert finding, expert practice databases, knowledge mapping, and so on.

MITRE's knowledge management strategy aims to enhance its operations by leveraging internal and external expertise and assets, supporting exchange of knowledge among individuals and groups (e.g., via technical exchange meetings), facilitating knowledge reuse through capturing and sharing knowledge assets (e.g., lessons learned databases), and transferring knowledge captured explicitly in knowledge assets back to people (knowledge internalization). It also includes capture of knowledge from people to create tangible knowledge assets and internalization of knowledge within staff. MITRE's director of knowledge management serves as a corporate steward of the strategy, which is shared among the supporting and line organizations. This extends to business unit knowledge management champions, who help stimulate KM initiatives.

Results

Although MITRE's size and budget are restricted by the government, KM enables it to deliver more work faster to its customers. Since 1995, MITRE has invested millions of dollars in a variety of KM systems; in return, it has reaped an order-of-magnitude ROI in reduced operations cost and improved productivity. According to corporate executives, before the KM initiatives MITRE was successful at what it was doing, but now, with KM, they are very successful, because they can leverage the collective knowledge of the company for every project. KM systems embody MITRE's mission statement—"solutions that make a difference" which has become "the way of life" for them. Recognizing the value of KM, MITRE is constantly looking for ways to improve its *culture of sharing* by empowering people, streamlining processes, and advancing technologies.

Questions for the Opening Vignette

1. What is MITRE, and why is KM critical to its success?
2. What problems led to MITRE's explorations of KM solutions?

3. Describe MITRE's holistic approach to KM. Discuss the value of individual layers and concepts. Is there anything in this approach that you do not agree with?
4. Describe the benefits of MITRE's KM systems. Can you think of other benefits (tangible or intangible) that are not mentioned in the case?
5. Explain how new Internet technologies (such as Web 2.0) can further enable the KM system at MITRE.

What We Can Learn from This Vignette

At large corporations like MITRE where knowledge is the core enabling asset, maximum leverage of intellectual capital is imperative. In its early years, MITRE was not structured in a way that encouraged knowledge sharing, and what little sharing there was generally took place in an unsystematic, informal way. As demand for its services increased, MITRE felt the need to better utilize its intellectual assets and started to develop KM systems. Over time, MITRE's organizational culture changed from the "culture of silos" to the "culture of sharing" as a number of successful KM initiatives and systems were developed. As the case illustrates, knowledge management is not a single task or project, but rather a continuous process of many tasks and projects. Corporate success will increasingly hinge on an organization's ability to turn knowledge management into its way of life.

Sources: R. Swanborg, "Mitre's Knowledge Management Journey," *CIO*, February 2009; and M. T. Maybury, "Knowledge Management at the MITRE Corporation," 2003, **mitre.org/work/tech_papers/tech_ papers_03/maybury_knowledge/KM_MITRE.pdf** (accessed June 2009).

11.2 INTRODUCTION TO KNOWLEDGE MANAGEMENT

Knowledge management is a broad discipline that is defined and explained in the following section.

Knowledge Management Concepts and Definitions

The opening vignette illustrates the importance and value of identifying an organization's knowledge assets and sharing them throughout the organization. In a series of initiatives, MITRE developed KM systems to leverage its intellectual assets, or **intellectual capital**—the valuable knowledge of its employees. MITRE's culture was transformed through the deployment of KM systems, leading to significantly lower operating costs, higher efficiency, and more collaboration throughout the organization. Although their worth is difficult to measure, organizations recognize the value of their intellectual assets. Fierce global competition drives companies to better use their intellectual assets by transforming themselves into organizations that foster the development and sharing of knowledge.

With roots in organizational learning and innovation, the idea of KM is not new (see Ponzi, 2004; and Schwartz, 2006). However, the application of IT tools to facilitate the creation, storage, transfer, and application of previously uncodifiable organizational knowledge is a new and major initiative in many organizations. Successful managers have long used intellectual assets and recognized their value. But these efforts were not systematic, nor did they ensure that knowledge gained was shared and dispersed appropriately for maximum organizational benefit. Knowledge management is a process that helps organizations identify, select, organize, disseminate, and transfer important information and expertise that are part of the organization's memory and that typically reside within the organization in an unstructured manner. **Knowledge management (KM)** is the systematic and active management of ideas, information, and knowledge residing in an organization's employees. The structuring of knowledge enables effective and efficient problem solving, dynamic learning, strategic planning,

and decision making. KM initiatives focus on identifying knowledge, explicating it in such a way that it can be shared in a formal manner, and leveraging its value through reuse. The information technologies that make KM available throughout an organization are referred to as *KM systems* (see Holsapple, 2003a, 2003b; Park and Kim, 2006; Sedighi, 2006; and Zhang and Zhao, 2006).

Through a supportive organizational climate and modern IT, an organization can bring its entire organizational memory and knowledge to bear on any problem, anywhere in the world, and at any time (see Bock et al., 2005). For organizational success, knowledge, as a form of capital, must be exchangeable among persons, and it must be able to grow. Knowledge about how problems are solved can be captured so that KM can promote organizational learning, leading to further knowledge creation.

Knowledge

Knowledge is very distinct from data and information (see Figure 11.2). Data are facts, measurements, and statistics; information is organized or processed data that is timely (i.e., inferences from the data are drawn within the time frame of applicability) and accurate (i.e., with regard to the original data) (Kankanhalli et al., 2005). **Knowledge** is information that is contextual, relevant, and actionable. For example, a map that gives detailed driving directions from one location to another could be considered data. An up-to-the-minute traffic bulletin along the freeway that indicates a traffic slowdown due to construction several miles ahead could be considered information. Awareness of an alternative, back-road route could be considered knowledge. In this case, the map is considered data because it does not contain current relevant information that affects the driving time and conditions from one location to the other. However, having the current conditions as information is useful only if you have knowledge that enables you to avert the construction zone. The implication is that knowledge has strong experiential and reflective elements that distinguish it from information in a given context.

Having knowledge implies that it can be exercised to solve a problem, whereas having information does not carry the same connotation. An ability to act is an integral part of being knowledgeable. For example, two people in the same context with the same information may not have the same ability to use the information to the same degree of success. Hence, there is a difference in the human capability to add value. The differences in ability may be due to different experiences, different training, different perspectives, and other factors. Whereas data, information, and knowledge may all be viewed as assets of an organization, knowledge provides a higher level of meaning about data and information. It conveys meaning and hence tends to be much more valuable, yet more ephemeral.

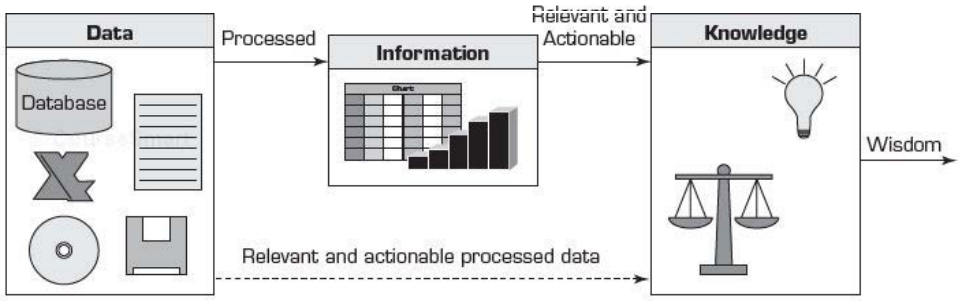

FIGURE 11.2 Relationships Among Data, Information, and Knowledge

Unlike other organizational assets, knowledge has the following characteristics (see Gray, 1999):

- ***Extraordinary leverage and increasing returns.*** Knowledge is not subject to diminishing returns. When it is used, it is not decreased (or depleted), rather it is increased (or improved). Its consumers can add to it, thus increasing its value.
- ***Fragmentation, leakage, and the need to refresh.*** As knowledge grows, it branches and fragments. Knowledge is dynamic; it is *information in action*. Thus, an organization must continually refresh its knowledge base to maintain it as a source of competitive advantage.
- ***Uncertain value.*** It is difficult to estimate the impact of an investment in knowledge. There are too many intangible aspects that cannot be easily quantified.
- ***Value of sharing.*** It is difficult to estimate the value of sharing one's knowledge or even who will benefit most from it.

Over the past few decades, the industrialized economy has been going through a transformation from being based on natural resources to being based on intellectual assets (see Alavi, 2000; and Tseng and Goo, 2005). The **knowledge-based economy** is a reality (see Godin, 2006). Rapid changes in the business environment cannot be handled in traditional ways. Firms are much larger today than they used to be, and, in some areas, turnover is extremely high, fueling the need for better tools for collaboration, communication, and knowledge sharing. Firms must develop strategies to sustain competitive advantage by leveraging their intellectual assets for optimal performance (e.g., in the National Basketball Association; see Berman et al., 2002). Competing in the globalized economy and markets requires quick response to customer needs and problems. To provide service, managing knowledge is critical for consulting firms spread out over wide geographical areas and for virtual organizations (see Application Case 11.1).

There is a vast amount of literature about what knowledge and knowing mean in epistemology (i.e., the study of the nature of knowledge), the social sciences, philosophy, and psychology. Although there is no single definition of what knowledge and KM specifically mean, the business perspective on them is fairly pragmatic. Information as a resource is not always valuable (i.e., information overload can distract from what is important); knowledge as a resource is valuable because it focuses attention back toward what is important (see Carlucci and Schiuma, 2006; and Hoffer et al., 2002). Knowledge implies an implicit understanding and experience that can discriminate between its use and misuse. Over time, information accumulates and decays, whereas knowledge evolves. Knowledge is dynamic in nature. This implies, though, that today's knowledge may well become tomorrow's ignorance if an individual or organization fails to update knowledge as environmental conditions change. For more on the potential drawbacks of managing and reusing knowledge, see Section 11.9.

The term *intellectual capital*, often used as a synonym for knowledge, implies that there is a financial value to knowledge. Not all intellectual capital can be classified as knowledge. Brand and customer are aspects of intellectual capital, but in today's marketplace the most significant and valuable aspect of intellectual capital is indeed knowledge in all its forms (see Ariely, 2006). Although intellectual capital is difficult to measure, some industries have tried. For example, in 2000 the value of the intellectual capital of the property-casualty insurance industry was estimated to be between $270 billion and $330 billion (see Mooney, 2000).

Knowledge evolves over time with experience, which puts connections among new situations and events in context. Given the breadth of the types and applications of knowledge, we adopt the simple and elegant definition that knowledge is information in action.

APPLICATION CASE 11.1

KM at Consultancy Firms

Knowledge has become one of the most highly valued commodities in the modern economy, and as a consequence we may be witnessing the emergence of a knowledge-based economy. In this new economy, knowledge-intensive firms play a key role. Consultancy firms are typically defined as being knowledge-intensive because knowledge is considered to assume greater importance than all other forms of input. Their main assets are said to stem from the knowledge and competence of their personnel, and, like other knowledge-intensive firms, they tend to produce results based on the capacity and expertise of their employees.

For such organizations, the ability to develop and exploit knowledge faster than their competitors is a key component of their competitive success. The management of this crucial resource therefore forms a core function for consultancies, because such employee/organizational knowledge must be continuously managed and enhanced in order to retain existing advantages and create new ventures. Following are a few factors that make it imperative for consultancy firms to develop very effective KM programs:

- Consultancy implies leveraging high levels of contextual knowledge for others.
- Consultancy firms deal with difficult, often unique, problems of their clients.
- Solving challenging problems requires deep knowledge and experience on the part of the consultants.
- Consultants constantly move to other cases/projects, thus developing experience-based inimitable knowledge that not only helps in solving problems but also assists in dealing with all stakeholders (e.g.., clients, coworkers, managers). in an optimal and balanced manner.
- Consultancy companies tend to have high employee turnover rates. Consultants experience burnout from dealing constantly with challenging problems; frequently readjusting to different environments, people, and cultures; and travel demands. Many receive better offers from other companies because of their invaluable problem-solving skills. Others want a more routine lifestyle where they can spend more time with their families.

Even though consultancy companies are prime targets for KM studies, substantial gaps remain in our understanding of the ways in which they manage their intellectual capital. This may be attributed to the fact that they not only use such mechanisms to manage their own knowledge, but also to solve clients' KM problems. Hence, many consultancy companies treat their KM strategies as trade secrets that make them win client contracts.

Donnelly (2008) conducted a comparative study of the KM practices deployed by a multinational consultancy firm. He utilized a case study approach of one of the "Big Four" consultancy firm's business operations in the United Kingdom and The Netherlands. As many of the largest multinational consultancies in the world originated in the US/UK and have expanded internationally in order to meet the needs of their multinational clients, they are likely to have transferred management practices across their operations. Furthermore, indigenous consultancies are often thought to replicate their practices in order to emulate their success and to avoid uncertainty or the risk of being out of step with their US/UK competitors.

In both the United Kingdom and The Netherlands, the firm used four principal mechanisms to diffuse employee/organizational knowledge:

- Team-based interaction (to share partially tacit knowledge)
- Electronic libraries/databases and intranet-based knowledge forums (to share mostly explicit knowledge)
- A coach–apprentice training model (to share pure tacit knowledge)
- Network relationships (to develop know-who knowledge)

Despite these mechanisms, the firm was found to face a number of strong obstacles in attempting to impart knowledge at both the local and national/international levels:

- The firm was highly dependent upon the willingness of its employees to allow their knowledge to be codified.
- Hierarchical relations were found to inhibit knowledge sharing between members at different levels within the firm.

- "Knowledge hoarding" occurred. Because knowledge was linked to power and an individual's position in networks and the firm, employees were reluctant to share their knowledge.
- Competitive tensions were a problem. Some of the firm's employees indicated that they did not wish to lose their "edge" by sharing their knowledge, because it could reduce firm dependency, client demand, and chargeability rates, and, therefore, the likelihood of achieving promotion.
- Information leakage was a concern, because valuable knowledge could be leaked to competitors within and outside the firm.
- There was a fear of criticism in that errors could be identified by colleagues or superiors.
- Time pressure was a problem. Knowledge sharing was a nonchargeable activity and, therefore, had to be accommodated in a finite amount of nonchargeable time or otherwise accomplished in an individual's own unpaid time.
- There was employee apathy toward the firm's knowledge forums/databases.
- There was a lack of rewards associated with knowledge sharing.

According to the study participants, the most significant of these obstacles was knowledge hoarding (i.e., a premeditated attempt to hide knowledge for individual purposes). Certain employees were real gurus who were quite productive in their tasks and yet very protective of their knowledge. They keep it, especially the really technical stuff, because they don't want it abused. If you have special technical planning which will save companies lots of money, you'll want to protect it because if exposed it would lose its value. Rather than leveraging their knowledge capabilities across the entire organization, individuals retained their knowledge because such intellectual capital was said to be synonymous with status and power. Consequently, key items of information were retained by knowledgeable individuals in order to give themselves a competitive advantage over their colleagues.

In summary, consultancy firms are not much different than other knowledge-intensive businesses in that they seek to continuously improve their knowledge management practices by paying due attention to people, processes, and technology-related issues.

Sources: Based on R. Donnelly, "The Management of Consultancy Knowledge: An Internationally Comparative Analysis," *Journal of Knowledge Management*, Vol. 12, No. 3, 2008, pp. 71–83; and M. R. Haas and M. T. Hansen, "When Using Knowledge Can Hurt Performance: The Value of Organizational Capabilities in a Management Consulting Company," *Strategic Management Journal*, Vol. 26, No. 1, 2005, pp. 1–24.

Explicit and Tacit Knowledge

Polanyi (1958) first conceptualized the difference between an organization's explicit and tacit knowledge. **Explicit knowledge** deals with more objective, rational, and technical knowledge (e.g., data, policies, procedures, software, documents). **Tacit knowledge** is usually in the domain of subjective, cognitive, and experiential learning; it is highly personal and difficult to formalize. Alavi and Leidner (2001) provided a taxonomy (see Table 11.1), where they defined a spectrum of different types of knowledge, going beyond the simple binary classification of explicit versus tacit. However, most KM research has been (and still is) debating over the dichotomous classification of knowledge.

Explicit knowledge comprises the policies, procedural guides, white papers, reports, designs, products, strategies, goals, mission, and core competencies of an enterprise and its IT infrastructure. It is the knowledge that has been codified (i.e., documented) in a form that can be distributed to others or transformed into a process or strategy without requiring interpersonal interaction. For example, a description of how to process a job application would be documented in a firm's human resources policy manual. Explicit knowledge has also been called **leaky knowledge** because of the ease with which it can leave an individual, a document, or an organization due to the fact that it can be readily and accurately documented (see Alavi, 2000).

Tacit knowledge is the cumulative store of the experiences, mental maps, insights, acumen, expertise, knowhow, trade secrets, skill sets, understanding, and learning that an organization has, as well as the organizational culture that has embedded in it the past

TABLE 11.1 Taxonomy of Knowledge

Knowledge Type	Definition	Example
Tacit	Knowledge is rooted in actions, experience, and involvement in specific context.	Best means of dealing with specific customer
Cognitive tacit:	Mental models	Individual's belief on cause-effect relationships
Technical tacit:	Know-how applicable to specific work	Surgery skills
Explicit	Articulated, generalized knowledge	Knowledge of major customers in a region
Individual	Created by and inherent in the individual	Insights gained from completed project
Social	Created by and inherent in collective actions of a group	Norms for intergroup communication
Declarative	Know-about	What drug is appropriate for an illness
Procedural	Know-how	How to administer a particular drug
Causal	Know-why	Understanding why the drug works
Conditional	Know-when	Understanding when to prescribe the drug
Relational	Know-with	Understanding how the drug interacts with other drugs
Pragmatic	Useful knowledge for an organization	Best practices, treatment protocols, case analyses, post mortems

and present experiences of the organization's people, processes, and values. Tacit knowledge, also referred to as *embedded knowledge* (see Tuggle and Goldfinger, 2004), is usually either localized within the brain of an individual or embedded in the group interactions within a department or a branch office. Tacit knowledge typically involves expertise or high skill levels.

Sometimes tacit knowledge could easily be documented but has remained tacit simply because the individual housing the knowledge does not recognize its potential value to other individuals. Other times, tacit knowledge is unstructured, without tangible form, and therefore difficult to codify. It is difficult to put some tacit knowledge into words. For example, an explanation of how to ride a bicycle would be difficult to document explicitly and thus is tacit. Successful transfer or sharing of tacit knowledge usually takes place through associations, internships, apprenticeship, conversations, other means of social and interpersonal interactions, or even simulations (see Robin, 2000). Nonaka and Takeuchi (1995) claimed that intangibles such as insights, intuitions, hunches, gut feelings, values, images, metaphors, and analogies are the often-overlooked assets of organizations. Harvesting these intangible assets can be critical to a firm's bottom line and its ability to meet its goals. Tacit knowledge sharing requires a certain context or situation in order to be facilitated because it is less commonly shared under normal circumstances (see Shariq and Vendelø, 2006).

Historically, management information systems (MIS) departments have focused on capturing, storing, managing, and reporting explicit knowledge. Organizations now recognize the need to integrate both types of knowledge in formal information systems. For centuries, the mentor–apprentice relationship, because of its experiential nature, has been a slow but reliable means of transferring tacit knowledge from individual to individual. When people leave an organization, they take their knowledge with them. One critical goal of knowledge management is to retain the valuable knowhow that can so easily and quickly leave an organization. **Knowledge management systems (KMS)** refer to the use of modern IT (e.g., the Internet, intranets, extranets, Lotus Notes, software filters, agents, data warehouses, Web 2.0) to systematize, enhance, and expedite intra- and interfirm KM.

KM systems are intended to help an organization cope with turnover, rapid change, and downsizing by making the expertise of the organization's human capital widely accessible. They are being built, in part, because of the increasing pressure to maintain a well-informed, productive workforce. Moreover, they are built to help large organizations provide a consistent level of customer service, as illustrated in Application Case 11.2. For more on the basics of knowledge and the economy, see Ahlawat and Ahlawat (2006) and Holsapple (2003a, 2003b).

APPLICATION CASE 11.2

Cingular Calls on Knowledge

How do you make sure that each of your customer service agents at 22 call centers nationwide can answer virtually any question asked by one of your 22 million clients? That was the challenge faced by Cingular Wireless (**cingular.com**), a major mobile communications provider based in Atlanta (now a part of AT&T wireless services).

Cingular Wireless turned to KM to accomplish this massive task. Cingular benchmarked KM solutions of technology oriented companies, such as Dell and Microsoft. Steve Mullins, vice president of customer experience for Cingular Wireless, and Monica Browning, Cingular's director of knowledge management, met with several KM software vendors to learn how their tools operate. "We thought about how [the knowledge management software] would integrate with what we envisioned the future desktop to look like," said Mullins. "This system would be the foundation for what we use throughout all of our departments."

Following a review of KM solutions used by other companies, Cingular chose eService Suite by ServiceWare (**serviceware.co.jp**). ServiceWare's decision integrity department helped Cingular put together a basis for proving the software's return on investment. To ensure successful implementation of the system, Cingular embarked on a campaign to obtain the support of everyone involved, from senior executives to each call center agent who would use the system. A pilot program was initiated in technical support departments at three call centers.

To help manage the organizational changes that accompany a shift to knowledge management, Cingular enlisted the help of leading consulting firms Cap Gemini Ernst & Young and Innovative Management Solutions.

A major issue in developing the KMS involved capturing knowledge and storing it in the system. Cingular accomplished this by combining the efforts of its employees and an external authoring group from Innovative Management Solutions. Cingular divided the process into phases. This made it possible to populate the knowledge base with technical support information, common topics, information on rate plans, and so on. Browning estimated that it took about 4 months for the knowledge repository to be ready for the first group of users.

The Cingular KMS uses complex (artificial intelligence–based) algorithms to process natural language queries and provide customer service agents with lists of the most likely answers to their

questions. The software also determines the relevance of possible answers by ranking them partly on exact text and phrase matching. In addition, the system can match synonyms and assign additional weight to certain expressions. The system attempts to provide even more focused solutions by retrieving answers from the pool of knowledge that is relevant to a particular user and his or her profile.

Understanding that knowledge must grow and evolve, Cingular encourages users to contribute their expertise to the system. The software can automatically record a sequence of steps that an agent took to find a correct solution to a certain problem and give the agent an option to provide additional feedback.

Cingular realized that ensuring validity and integrity of the knowledge stored and distributed by the KMS is one of the key factors of the system's success. To that end, the company has a knowledge management team that is responsible for monitoring, maintaining, and expanding the system. The team consists of about 25 full-time employees based in Cingular's Atlanta headquarters. The knowledge management team works closely with various departments of the company and subject-matter experts to ensure that the knowledge base has the right answers in a user-friendly format at the right time. In addition, the team reviews contributions to the knowledge base made by the agents and makes appropriate changes or additions to the knowledge base.

Cingular's clients are often the ultimate beneficiaries of the company's knowledge. That is why Cingular plans to bring its knowledge closer to its customers by extending the KMS online and to retail stores. Customers will be able to access instructions on using wireless services and features, handsets, and other devices that Cingular carries, as well as troubleshooting tips.

Sources: Adapted from J. O'Herron, "Building the Bases of Knowledge," *Call Center Magazine*, January 2003; and Cingular Wireless Benefits Knowledge Management Web Site, 2005, **mergeagency.com/case_study.php?id=23** (accessed April 2006).

Section 11.2 Review Questions

1. Define *knowledge management* and describe its purposes.
2. Distinguish between knowledge and data.
3. Describe the knowledge-based economy.
4. Define *tacit knowledge* and *explicit knowledge*.
5. Define *KMS* and describe the capabilities of KMS.

11.3 ORGANIZATIONAL LEARNING AND TRANSFORMATION

Knowledge management is rooted in the concepts of organizational learning and organizational memory. When members of an organization collaborate and communicate ideas, teach, and learn, knowledge is transformed and transferred from individual to individual (see Bennet and Bennet, 2003; and Jasimuddin et al., 2006).

The Learning Organization

The term **learning organization** refers to an organization's capability of learning from its past experience. Before a company can improve, it must first learn. Learning involves an interaction between experience and competence. In communities of practice, these are tightly related. Communities of practice provide not only a context for newcomers to learn but also a context for new insights to be transformed into knowledge (see Wenger, 2002). We discuss communities of practice later in this chapter.

To build a learning organization, three critical issues must be tackled: (1) meaning (determining a vision of what the learning organization is to be), (2) management (determining how the firm is to work), and (3) measurement (assessing the rate and level of learning). A learning organization is one that performs five main activities well: solving problems systematically, experimenting creatively, learning from past experience, learning

from the best practices of others, and transferring knowledge quickly and efficiently throughout the organization (see Vat, 2006). For example, Best Buy deliberately and successfully structured its KM efforts around creating a learning organization where it captured best practices (see Brown and Duguid, 2002).

Organizational Memory

A learning organization must have an **organizational memory** and a means to save, represent, and share its organizational knowledge. Estimates vary, but it is generally believed that only 10 to 20 percent of business data are actually used. Organizations "remember" the past in their policies and procedures. Individuals ideally tap into this memory for both explicit and tacit knowledge when faced with issues or problems to be solved. Human intelligence draws from the organizational memory and adds value by creating new knowledge. A KMS can capture the new knowledge and make it available in its enhanced form. See Nevo and Wand (2005) and Jennex and Olfman (2003).

Organizational Learning

Organizational learning is the development of new knowledge and insights that have the potential to influence an organization's behavior. It occurs when associations, cognitive systems, and memories are shared by members of an organization (see Schulz, 2001). Learning skills include the following (see Garvin, 2000):

- Openness to new perspectives
- Awareness of personal biases
- Exposure to unfiltered data
- A sense of humility

Establishing a corporate memory is critical for success (see Hinds and Aronson, 2002). IT plays a critical role in organizational learning, and management must place emphasis on this area to foster it (see Ali et al., 2006; Craig, 2005; Davenport and Sena, 2003; and O'Leary, 2003).

Because organizations are becoming more virtual in their operations, they must develop methods for effective organizational learning. Modern collaborative technologies can help in KM initiatives. Organizational learning and memory depend less on technology than on people issues, as we describe next.

Organizational Culture

An organization's ability to learn, develop memory, and share knowledge is dependent on its culture. *Culture* is a pattern of shared basic assumptions (see Kayworth and Leidner, 2003; and Schein 1999). Over time, organizations learn what works and what doesn't work. As the lessons become second nature, they become part of the **organizational culture**. New employees learn the culture from their mentors, along with knowhow.

The impact of corporate culture on an organization is difficult to measure. However, strong culture generally produces strong, measurable bottom-line results: net income, return on invested capital, and yearly increases in stock price (see Hibbard, 1998). For example, Buckman Laboratories, a pharmaceutical firm, measures culture impact by sales of new products. Buckman undertook to change its organizational culture by making knowledge sharing part of the company's core values. After instituting a knowledge-sharing initiative, sales of products less than 5 years old rose to 33 percent of total sales, up from 22 percent (see Hibbard, 1998; also see Martin, 2000). Sharing initiatives and proper motivation are critical for the success of knowledge management. This is especially tricky in the public sector. However, an organizational culture that does not

foster sharing can severely cripple a KM effort (see Alavi et al., 2005/2006; Hinds and Aronson, 2002; Jones et al., 2006; and Riege, 2005).

Encouraging employees to use a KMS, both for contributing knowledge and for seeking knowledge, can be difficult. Riege (2005) reviewed past studies and identified a number of possible reasons that people do not like to share knowledge:

- General lack of time to share knowledge and time to identify colleagues in need of specific knowledge
- Apprehension or fear that sharing may reduce or jeopardize people's job security
- Low awareness and realization of the value and benefit of the knowledge others possess
- Dominance in sharing explicit over tacit knowledge, such as knowhow and experience that requires hands-on learning, observation, dialogue, and interactive problem solving
- Use of a strong hierarchy, position-based status, and formal power
- Insufficient capture, evaluation, feedback, communication, and tolerance of past mistakes that would enhance individual and organizational learning effects
- Differences in experience levels
- Lack of contact time and interaction between knowledge sources and recipients
- Poor verbal/written communication and interpersonal skills
- Age differences
- Gender differences
- Lack of a social network
- Differences in education levels
- Ownership of intellectual property due to fear of not receiving just recognition and accreditation from managers and colleagues
- Lack of trust in people because they may misuse knowledge or take unjust credit for it
- Lack of trust in the accuracy and credibility of knowledge due to the source
- Differences in national culture or ethnic backgrounds and values and beliefs associated with it

Sometimes a technology project fails because the technology does not match the organization's culture. (This is a much deeper issue than having a poor fit between the technology and the task and hand; see McCarthy et al., 2001.) This is especially true for KMS, because they rely so heavily on individuals contributing their knowledge. Most KMS that fail in practice do so because of organizational culture issues (see Zyngier, 2006).

Successful organizations are often characterized by their ability to manage risk associated with technology projects. Risk management and KM are not mutually exclusive management practices. They often overlap in the way that they contextualize the organizational practices. Application Case 11.3 provides a good example of how a large organization like NASA blends the two management practices for their mutual benefit.

APPLICATION CASE 11.3

NASA Blends KM with Risk Management

The mission of NASA's Exploration Systems Mission Directorate (ESMD) is to develop a sustained human presence on the Moon; to promote exploration, commerce, and U.S. preeminence in space; and to serve as a stepping stone for the future exploration of Mars and other destinations. In order to achieve its mission, ESMD initiated efforts to integrate knowledge management and risk management with measurable results. The idea behind the initiative was to not only learn lessons from past programs, such as Apollo, the Space Shuttle, and the International Space Station, but also to generate

and share new knowledge in the form of engineering design, operations, and management best practices through ongoing activities and risk management procedures. The underlying assumption was that risks highlight potential "knowledge gaps" that might be mitigated through one or more KM practices and artifacts. These same risks also provide a cueing function for the collection of knowledge, particularly on technical or programmatic challenges that might occur again.

In a fast-paced, resource-constrained environment, ESMD must budget its assets carefully to mitigate risks, while simultaneously capturing and transferring knowledge about risk. To accomplish this, ESMD risk and knowledge management practitioners use a set of interrelated risk and KM processes, including:

- ***Pause and Learn (PaL).*** The idea behind PaL is to create "learning events" at major milestones in the lifecycle of a lengthy project. Key characteristics of PaL includes (1) an informal, facilitated roundtable discussion, (2) a "not for attributions" approach where judgments about success or failure are withheld, (3) a clear narrow focus on a particular project phase, (4) participation of all who are involved, and (5) a timely approach, where PaL is conducted during the execution of a project 's phases.
- ***Knowledge-based risks (KBRs).*** ESMD tightly couples continuous risk management and lessons learned to form an active collection of KBRs. By definition, a KBR can be a pertinent lessons learned record, converted to a risk record; or an ESMD risk, with lessons on how the risk was identified and mitigated over time appended to the risk record.
- ***Web-enabled high-performance teams.*** Given the inherent problems in managing an organizational structure as complex as ESMD, with work spread across all NASA centers, a wiki-type collaboration medium was found to be an excellent fit. This way, ESMD teams are empowered to collaborate on documents, manage calendars, locate process and expertise information, and, most important, learn from each other.
- ***Knowledge-sharing forums.*** Knowledge-sharing forums at ESMD range from simple "brown bag" lunch seminars to larger conferences. Events include ESMD alumni events, in which past participants in NASA projects discuss experiences and lessons learned; knowledge-sharing seminars and workshops, where senior project leaders share their insights; and other events that bring together project leaders from across NASA, private industry, and other government agencies.
- ***Experience-based training.*** Case studies, both internal and external to ESMD, are used to capture and transfer relevant and contextual information to management and the workforce.

A combination of these practices provides ESMD with a menu of options to enhance risk-informed decision making in a measurable fashion. ESMD has been careful not to overemphasize information technology in its approach, which in the past resulted in several "IT junkyards."

The Vision for Space Exploration program provides ESMD personnel with exciting opportunities and formidable challenges. To reduce risk and apply knowledge more effectively, ESMD is integrating its risk and knowledge management practices and systems in a comprehensive manner that will accomplish more with less bureaucracy. The goal is not compliance with detailed processes and procedures, but rather compliance with intent—the intent to learn and share and to probe multiple aspects of risks, so that ESMD's missions have the best possible chances of success.

Sources: D. Lengyel, "Blending KM with Risk Management at NASA," *Knowledge Management Review*, Vol. 10, No. 6, 2008, pp. 8–9; and NASA's Exploration Systems Mission Directorate (ESMD) Implementation Plan, **nasa.gov/pdf/187112main_eip_web.pdf** (accessed June 2009).

Section 11.3 Review Questions

1. Define *learning organization* and identify the characteristics of learning organizations.
2. Define *organizational memory.*
3. Describe organizational learning.
4. Define *organizational culture* and relate it to knowledge management.

11.4 KNOWLEDGE MANAGEMENT ACTIVITIES

This section describes several major activities that take place in knowledge management projects.

Knowledge Management Initiatives and Activities

Given the changing dynamics of the global marketplace and the increasingly intense competition, organizations need to leverage intellectual resources in order to reduce the loss of intellectual capital due to people leaving the company, as well as to reduce costs by decreasing the number of times the company has to repeatedly solve the same problem. IDC estimated that the cost for an organization of 1,000 knowledge workers to find existing knowledge they need, to waste time searching for nonexistent knowledge, and to re-create knowledge that is available but cannot be located can be more than $6 million per year (see Weiss et al., 2004). In addition, knowledge has been recognized as the single most important source for generating value in the modern company (see Weir, 2004). For instance, companies can use business intelligence (BI) to reveal opportunities and then create revenue-generating programs to exploit them. In some highly skilled professions, such as medicine, retaining and using knowledge of best practices are critical in life-and-death situations (see Lamont, 2003a). It is precisely these types of difficulties that have led to the systematic attempt to manage knowledge (see Compton 2001; and Holsapple 2003a, 2003b). Between early 2001 and early 2003, U.S. firms laid off 3.6 million workers (not including retirements). Nineteen percent of baby boomers in executive, administrative, or managerial positions are expected to retire by 2008. When people leave an organization, their knowledge assets leave with them; as Taylor (2001) said, "Intellectual capital has legs."

A KPMG Peat Marwick survey of European firms in 1998 found that almost half of the companies reported having suffered a significant setback due to losing key staff. Similarly, a Cranfield University survey conducted in the same year found that the majority of responding firms believed that much of the knowledge they needed existed inside the organization but that finding and leveraging it were ongoing challenges.

Most KM initiatives have one of three aims: (1) to make knowledge visible, mainly through maps, yellow pages, and hypertext; (2) to develop a knowledge-intensive culture; or (3) to build a knowledge infrastructure. These aims are not mutually exclusive, and, indeed, firms may attempt all three as part of a knowledge management initiative.

Several activities or processes surround the management of knowledge. These include the creation of knowledge, the sharing of knowledge, and the seeking and use of knowledge. Various terms have been used to describe these processes. More important than any particular label assigned to a knowledge activity is having an understanding of how knowledge flows through an organization (see Wenger et al., 2002).

Knowledge Creation

Knowledge creation is the generation of new insights, ideas, or routines. Nonaka (1994) described knowledge creation as an interplay between tacit and explicit knowledge and as a growing spiral as knowledge moves among the individual, group, and organizational levels. The four modes of knowledge creation are socialization, externalization, internalization, and combination. The socialization mode refers to the conversion of tacit knowledge to new tacit knowledge through social interactions and shared experience among organization members (e.g., mentoring). The combination mode refers to the creation of new explicit knowledge by merging, categorizing, reclassifying, and synthesizing existing explicit knowledge (e.g., statistical analyses of market data). The other two modes involve interactions and conversion between tacit and explicit knowledge.

Externalization refers to converting tacit knowledge to new explicit knowledge (e.g., producing a written document describing the procedures used in solving a particular client's problem). Internalization refers to the creation of new tacit knowledge from explicit knowledge (e.g., obtaining a novel insight through reading a document). For further information, see Wickramasinghe (2006).

Knowledge Sharing

Knowledge sharing is the willful explication of one person's ideas, insights, solutions, experiences (i.e., knowledge) to another individual either via an intermediary, such as a computer-based system, or directly. However, in many organizations, information and knowledge are not considered organizational resources to be shared but individual competitive weapons to be kept private. Organizational members may share personal knowledge with trepidation; they perceive that they are of less value if their knowledge is part of the organizational public domain. Research in organizational learning and knowledge management suggests that some facilitating conditions include trust, interest, and shared language (see Hanssen-Bauer and Snow, 1996); fostering access to knowledgeable members (see Brown and Duguid, 1991); and a culture marked by autonomy, redundancy, requisite variety, intention, and fluctuation (see King, 2006).

Knowledge Seeking

Knowledge seeking, also referred to as *knowledge sourcing* (see Gray and Meisters, 2003), is the search for and use of internal organizational knowledge. Lack of time or lack of reward may hinder the sharing of knowledge, and the same is true of knowledge seeking. Individuals may sometimes prefer to not reuse knowledge if they feel that their own performance review is based on the originality or creativity of their ideas. Such was the case for marketing employees in a global consumer goods organization described in Alavi et al. (2003).

Individuals may engage in knowledge creation, sharing, and seeking with or without the use of IT tools. For example, storytelling (described in Chapter 2 as a decision-making technique) is an ancient approach to transmitting and gathering knowledge. Nuances of how a story is told cue the gatherer as to importance and detail. Storytelling may be considered a form of verbal best practices. See Gamble and Blackwell (2002) and Reamy (2002) for details on how storytelling is used in knowledge management.

We next describe several common approaches to knowledge management.

Section 11.4 Review Questions

1. Why do companies need knowledge management initiatives?
2. Describe the process of knowledge creation.
3. What are the characteristics of knowledge sharing?
4. Define *knowledge seeking* (or sourcing).

11.5 APPROACHES TO KNOWLEDGE MANAGEMENT

The two fundamental approaches to knowledge management are the process approach and the practice approach (see Table 11.2). We next describe these two approaches as well as hybrid approaches.

The Process Approach to Knowledge Management

The **process approach** to knowledge management attempts to codify organizational knowledge through formalized controls, processes, and technologies (see Hansen et al., 1999). Organizations that adopt the process approach may implement explicit policies

TABLE 11.2 The Process and Practice Approaches to Knowledge Management

	Process Approach	Practice Approach
Type of knowledge supported	Explicit knowledge—codified in rules, tools, and processes	Mostly tacit knowledge—unarticulated knowledge not easily captured or codified
Means of transmission	Formal controls, procedures, and standard operating procedures, with heavy emphasis on information technologies to support knowledge creation, codification, and transfer of knowledge	Informal social groups that engage in storytelling and improvisation
Benefits	Provides structure to harness generated ideas and knowledge Achieves scale in knowledge reuse Provides spark for fresh ideas and responsiveness to changing environment	Provides an environment to generate and transfer high-value tacit knowledge
Disadvantages	Fails to tap into tacit knowledge May limit innovation and forces participants into fixed patterns of thinking	Can result in inefficiency Abundance of ideas with no structure to implement them
Role of information technology (IT)	Requires heavy investment in IT to connect people with reusable codified knowledge	Requires moderate investment in IT to facilitate conversations and transfer of tacit knowledge

Source: Compiled from M. Alavi, T. R. Kayworth, and D. E. Leidner, "An Empirical Examination of the Influence of Organizational Culture on Knowledge Management Practices," *Journal of Management Information Systems*, Vol. 22, No. 3, 2006, pp. 191–224.

governing how knowledge is to be collected, stored, and disseminated throughout the organization. The process approach frequently involves the use of IT, such as intranets, data warehousing, knowledge repositories, decision support tools, and groupware (see Ruggles, 1998) to enhance the quality and speed of knowledge creation and distribution in the organization. The main criticisms of the process approach are that it fails to capture much of the tacit knowledge embedded in firms and it forces individuals into fixed patterns of thinking (see Kiaraka and Manning, 2005). This approach is favored by firms that sell relatively standardized products that fill common needs. Most of the valuable knowledge in these firms is fairly explicit because of the standardized nature of the products and services. For example, a kazoo manufacturer has minimal product changes or service needs over the years, and yet there is steady demand and a need to produce the item. In these cases, the knowledge is typically static in nature.

Even large firms that use tacit knowledge, such as Cap Gemini Ernst & Young, have invested heavily to ensure that the process approach works efficiently. The 250 people at Cap Gemini Ernst & Young's Center for Business Knowledge manage an electronic repository and help consultants find and use information. Specialists write reports and analyses that many teams can use. Each of Cap Gemini Ernst & Young's more than 40 practice areas has a staff member who helps codify and store documents. The resulting area databases are linked through a network (see Hansen et al., 1999). Naturally, people-to-documents is not the only way consultants in firms such as Cap Gemini Ernst & Young and Accenture share knowledge; they talk with one another as well. But they do place a high degree of emphasis on the codification strategy (see Hansen et al., 1999).

The Practice Approach to Knowledge Management

In contrast to the process approach, the **practice approach** to knowledge management assumes that a great deal of organizational knowledge is tacit in nature and that formal controls, processes, and technologies are not suitable for transmitting this type of understanding. Rather than build formal systems to manage knowledge, the focus of this approach is to build the social environments or communities of practice necessary to facilitate the sharing of tacit understanding (see Hansen et al., 1999; Leidner et al., 2006; and Wenger and Snyder, 2000). These communities are informal social groups that meet regularly to share ideas, insights, and best practices. This approach is typically adopted by companies that provide highly customized solutions to unique problems. For these firms, knowledge is shared mostly through person-to-person contact. Collaborative computing methods (e.g., group support systems [GSS], e-mail) help people communicate. The valuable knowledge for these firms is tacit in nature, which is difficult to express, capture, and manage. In this case, the environment and the nature of the problems being encountered are extremely dynamic. Because tacit knowledge is difficult to extract, store, and manage, the explicit knowledge that points to how to find the appropriate tacit knowledge (i.e., people contacts, consulting reports) is made available to an appropriate set of individuals who might need it. Consulting firms generally fall into this category. Firms adopting the codification strategy implicitly adopt the network storage model in their initial KMS (see Alavi, 2000).

The challenge for firms that adopt the personalization strategy, and hence the network storage model, is to develop methods to make the valuable tacit knowledge explicit, capture it, and contribute it to and transfer it from a **knowledge repository** in a KMS. Several major consulting firms are developing methods to do so. They store pointers to experts within the KMS, but they also store the tips, procedures, and best practices, as well as the context in which they work. To make their personalization strategies work, firms such as Bain invest heavily in building networks of people and communications technology, such as telephone, e-mail, and videoconferencing. They also commonly have face-to-face meetings (see Hansen et al., 1999).

In reality, a KM initiative can, and usually does, involve both approaches. Process and practice are not mutually exclusive. Alavi et al. (2003) described the case of an organization that began its KM effort with a large repository but evolved the KM initiative into a community-of-practice approach that existed side-by-side with the repository. In fact, community members would pass information from the community forum to the organizational repository when they felt that the knowledge was valuable outside their community. Application Case 11.4 illustrates how Texaco successfully manages its knowledge by using the practice approach.

APPLICATION CASE 11.4

Texaco Drills for Knowledge

Texaco (**texaco.com**), a company that pumps over a million barrels of oil a day, has discovered a new source of power: the collective knowledge and expertise of its 18,000 employees in 150 countries around the world. Texaco believes that connecting people who have questions with people who have answers gives it the power to work faster and more efficiently.

At Texaco, managing knowledge is a critical business challenge. John Old, Texaco's knowledge guru, approaches this challenge with a strategy that leverages human connections. Old has stated that knowledge, by its nature, is contextual; thus, systems that simply allow people to record what they know are ineffective. He strongly believes that a successful KM solution must recognize the importance of human connections.

Texaco uses technology to help people build personal relationships and share knowledge. One of the systems at work at Texaco is PeopleNet, a search engine for employees on the company's intranet. Employees who have questions can use PeopleNet to review profiles of their colleagues who might have the right answers. Texaco discovered that having biographies and pictures of its employees online makes it possible to establish credibility and trust between people who have not met each other. And it is trust that makes effective knowledge transfer possible.

Another tool that Texaco uses to connect its employees is a software system called Knowledge Mail from Tacit Knowledge Systems. This software analyzes e-mail sent and received by employees to help them make good contacts with colleagues who work on the same issues.

John Old has spoken of several important lessons that Texaco has learned while managing knowledge. He pointed out that people are more eager to share knowledge when they are united by a clear, specific, and measurable business purpose. Knowledge sharing becomes even more successful when they trust each other and see direct benefits that can be derived from the knowledge exchange. In addition, it is important to give people enough time to reflect on what they know and what they need to learn.

Texaco's approach to KM has provided many positive results. The knowledge management efforts help Texaco's employees successfully resolve numerous issues, ranging from adjusting oil well pumps to deciding whether to enter into new lines of business.

Sources: Compiled from F. Warner, "He Drills for Knowledge," *Fast Company,* September 2001; and D. Drucker, "Theory Doesn't Equal Practice," Internetweek.com, January 29, 2001, **internetweek.cmp.com/newslead01/lead012901.htm** (accessed April 2006).

Hybrid Approaches to Knowledge Management

Many organizations use a hybrid of the process and practice approaches. Early in the development process, when it may not be clear how to extract tacit knowledge from its sources, the practice approach is used so that a repository stores only explicit knowledge that is relatively easy to document. The tacit knowledge initially stored in the repository is contact information about experts and their areas of expertise. Such information is listed so that people in the organization can find sources of expertise (e.g., the process approach). From this start, best practices can eventually be captured and managed so that the knowledge repository will contain an increasing amount of tacit knowledge over time. Eventually, a true process approach may be attained. But if the environment changes rapidly, only some of the best practices will prove useful. Regardless of the type of KMS developed, a storage location for the knowledge (i.e., a knowledge repository) of some kind is needed.

The J.D. Edwards intranet-based Knowledge Garden helps its consultants share best practices (i.e., practice approach) and find subject experts (i.e., process approach) who can help them solve problems faster and more consistently. The application codifies the company's knowledge base, using Site Server taxonomies, and delivers personalized updates automatically based on user needs (see Microsoft, 2000).

Hansen et al. (1999) indicated that firms that attempted to straddle the two strategies (i.e., to use about half of each) in their knowledge management efforts have generally failed. Management consulting firms run into serious trouble when they straddle the strategies. When firms use either strategy exclusively, they also run into trouble. The most successful efforts involve about an 80/20 split in the strategies. With the practice approach, there is a need to provide some codified knowledge in a repository so that people can access it on an as-needed basis. With the process approach, it is necessary to provide access to knowledge contributors, because additional advice and explanations might prove useful or even necessary.

Certain highly skilled, research-oriented industries exhibit traits that require nearly equal efforts with both approaches. For example, Koenig (2001) argued that the pharmaceutical firms in which he has worked require about a 50/50 split. We suspect that industries that require both a lot of engineering effort (i.e., how to create products) and heavy-duty research effort (where a large percentage of research is unusable) would fit the 50/50 hybrid category. Ultimately, any knowledge that is stored in a knowledge repository must be reevaluated; otherwise, the repository will become a knowledge landfill.

For more examples of similar strategies and practices, see Gamble and Blackwell (2002) and Martin (2000). Technology Insights 11.1 provides an interesting bidirectional model to KM.

TECHNOLOGY INSIGHTS 11.1 KM: A Demand-Led Business Activity

According to Murray (2002), one of the main reasons that today's businesses are not able to derive real benefits from their KM efforts is that they view KM as a supply-side issue, believing that the acquisition of knowledge automatically produces benefits. He argued that KM should be more of a demand-side initiative as opposed to a supply-side automation process. Figure 11.3 shows a high-level process model to knowledge management.

The conventional way of interpreting the model is to read it from left to right, as a supply-side value chain. The process starts with basic data and progresses through the stages, each one progressively yielding more value, culminating in worthy business results. The closer to the left (the data end), the emphasis is more on automation and technology; toward the right (the result end), the emphasis is more on people and decision making.

The DIKAR (Data-Information-Knowledge-Action-Results) model in the left to right mode is useful in identifying, collecting, and storing data and information assets of the organization in a systematic manner. It is a technology-driven approach to automate the process of knowledge accumulation from what is available in organizational memory. The assumption is that once you have compiled the data, information, and knowledge (because you are able to do so with automated means), you will be able to figure out a way to productively use it for specific business actions. Unfortunately, establishing the seemingly simple connection between the accumulated knowledge assets and the necessary business actions is not a trivial task. Because of the vast variety of business situations, the knowledge nuggets that the decision maker needs to initiate the right action for a specific situation may not be in the right form to be recognized or often may not even

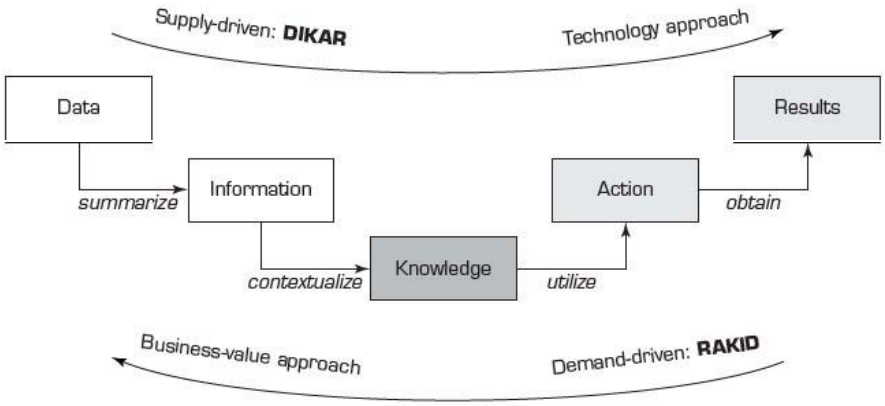

FIGURE 11.3 Bidirectional KM Process Model *Source:* Peter Murray, "Knowledge Management as a Sustained Competitive Advantage," *Ivey Business Journal*, March/April 2002, pp. 71–76.

exist in the knowledge repository. Therefore, investing in a DIKAR type knowledge management model may not generate significant return on investment to be viable.

The RAKID (Results-Action-Knowledge-Information-Data) model in the right to left mode aims to mitigate the shortcoming of the DIKAR model. RAKID starts with the business question "Given our desired results, what actions are needed to achieve them?" Once identified, the next question is "Given the identified set of actions, what do we need to know to effectively perform these actions?" That is, what knowledge nuggets are needed to identify and execute these actions? Once the necessary knowledge assets are identified, then the information and data sources are identified and processed to generate them. This way, only the necessary knowledge assets are generated to take the right actions to achieve the desired results. This process consumes fewer organizational resources and hence results in better return on investment for KM efforts.

Sources: Based on P. Murray, "Knowledge Management as a Sustained Competitive Advantage," *Ivey Business Journal,* March/April 2002, pp. 71–76; and M. W. McElroy, *The New Knowledge Management: Complexity, Learning, and Sustainable Innovation*, Burlington, MA: Butterworth-Heinemann, p. 145.

Best Practices

Best practices are the activities and methods that the most effective organizations use to operate and manage various functions. Chevron, for example, recognizes four levels of best practices (see O'Dell et al., 1998):

1. A good idea that is not yet proven but makes intuitive sense.
2. A good practice, an implemented technique, a methodology, a procedure, or a process that has improved business results.
3. A local best practice, a best approach for all or a large part of the organization based on analysis of hard data. In other words, the scope within the organization of the best practice is identified: Can it be used in a single department or geographical region, or can it be used across the organization or anywhere in between?
4. An industry best practice, similar to the third level but using hard data from industry.

Historically, the first knowledge repositories simply listed best practices and made them available within the firm. Now that knowledge repositories are electronic and Web accessible, they can have wide-ranging impact on the use of knowledge throughout a firm. For example, Raytheon has successfully used best practices to merge three distinct corporate cultures. See O'Dell and Grayson (2003) and O'Dell et al. (2003) for more on best practices.

Knowledge Repositories

A knowledge repository is neither a database nor a knowledge base in the strictest sense of the terms. Rather, a knowledge repository stores knowledge that is often text based and has very different characteristics. It is also referred to an organizational knowledge base. Do not confuse a knowledge repository with the knowledge base of an expert system. They are very different mechanisms: A knowledge base of an expert system contains knowledge for solving a specific problem. An organizational knowledge base contains all the organizational knowledge.

Capturing and storing knowledge are the goals for a knowledge repository. The structure of the repository is highly dependent on the types of knowledge it stores. The repository can range from simply a list of frequently asked (and obscure) questions and solutions, to a listing of individuals with their expertise and contact information, to detailed best practices for a large organization. Figure 11.4 shows a comprehensive KM architecture designed around an all-inclusive knowledge repository (Delen and Hawamdeh, 2009).

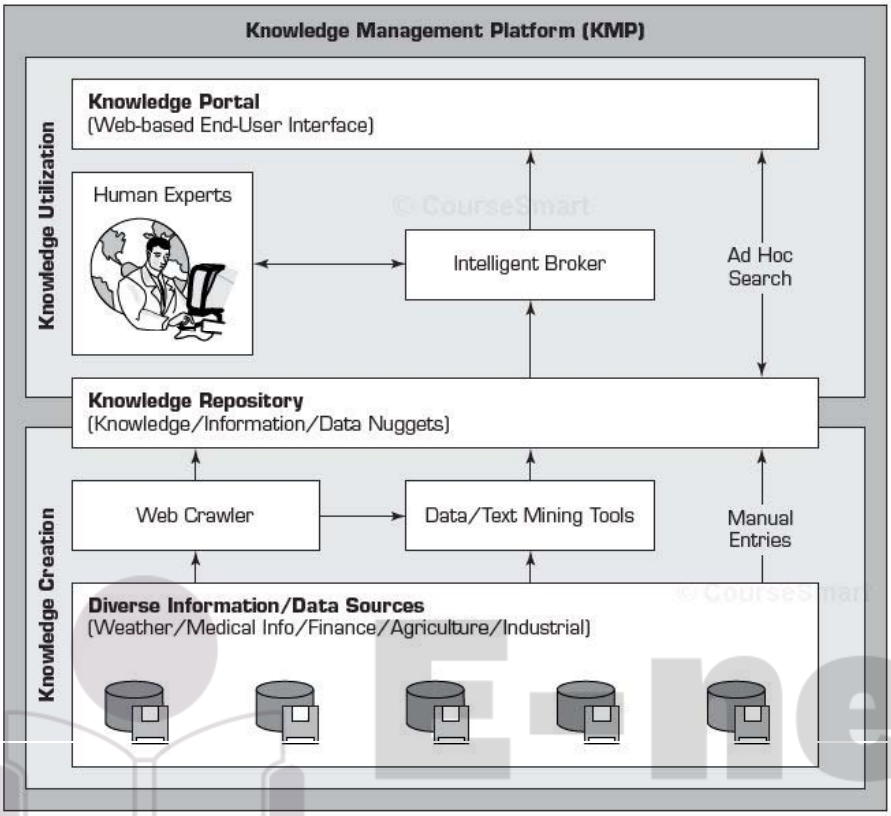

FIGURE 11.4 A Comprehensive View of a Knowledge Repository *Source:* D. Delen, and S.S. Hawamdeh, "A Holistic Framework for Knowledge Discovery and Management," *Communications of the ACM,* Vol. 52, No. 6, 2009, pp. 141–145.

Developing a Knowledge Repository

Most knowledge repositories are developed using several different storage mechanisms, depending on the types and amount of knowledge to be maintained and used. Each has strengths and weaknesses when used for different purposes within a KMS. Developing a knowledge repository is not an easy task. The most important aspects and difficult issues are making the contribution of knowledge relatively easy for the contributor and determining a good method for cataloging the knowledge. "One of the biggest hurdles in putting a formalized knowledge management structure to collaborative systems is making the structure as seamless as possible," said to Terry Jordan, vice president of marketing for Hyperwave (**hyperwave.com**). "You really have to make the process painless, or you lose all of the knowledge that you are trying to capture because people don't want to have to go through an enormous number of steps" (Zimmermann, 2003b). The users should not be involved in running the storage and retrieval mechanisms of the knowledge repository. Typical development approaches include developing a large-scale Internet-based system or purchasing a formal electronic document management system or a knowledge management suite. The structure and development of the knowledge repository are a function of the specific technology used for the KMS.

Measuring the success of a knowledge repository system is a tricky affair; the repository is only as good as the information stored in it and the willingness of the

target users to use it. Also, it is critical that the value of the repository be measured or estimated and that it continually be re-estimated, because the value is sure to fluctuate when knowledge reuse occurs and newer information is collected (see Qian and Bock, 2005).

Section 11.5 Review Questions

1. Describe the process approach to knowledge management.
2. Describe the practice approach to knowledge management.
3. Why is a hybrid approach to KM desirable?
4. Describe best practices as they relate to knowledge management.
5. Define *knowledge repository* and describe how to create one.

11.6 INFORMATION TECHNOLOGY (IT) IN KNOWLEDGE MANAGEMENT

The two primary functions of IT in knowledge management are retrieval and communication. IT also extends the reach and range of knowledge use and enhances the speed of knowledge transfer. Networks facilitate collaboration in KM.

The KMS Cycle

A functioning KMS follows six steps in a cycle (see Figure 11.5). The reason for the cycle is that knowledge is dynamically refined over time. The knowledge in a good KMS is never finished because the environment changes over time, and the knowledge must be updated to reflect the changes. The cycle works as follows:

1. ***Create knowledge.*** Knowledge is created as people determine new ways of doing things or develop knowhow. Sometimes external knowledge is brought in. Some of these new ways may become best practices.
2. ***Capture knowledge.*** New knowledge must be identified as valuable and be represented in a reasonable way.
3. ***Refine knowledge.*** New knowledge must be placed in context so that it is actionable. This is where human insights (i.e., tacit qualities) must be captured along with explicit facts.
4. ***Store knowledge.*** Useful knowledge must be stored in a reasonable format in a knowledge repository so that others in the organization can access it.
5. ***Manage knowledge.*** Like a library, a repository must be kept current. It must be reviewed to verify that it is relevant and accurate.
6. ***Disseminate knowledge.*** Knowledge must be made available in a useful format to anyone in the organization who needs it, anywhere and anytime.

As knowledge is disseminated, individuals develop, create, and identify new knowledge or update old knowledge, which they replenish in the system (see Allard, 2003; and Gaines, 2003).

Knowledge is a resource that is not consumed when used, although it can age (e.g., driving a car in 1900 was different from driving one now, but many of the basic principles still apply). Knowledge must be updated. Thus, the amount of knowledge grows over time.

Components of KMS

Knowledge management is more a methodology applied to business practices than a technology or a product. Nevertheless, IT is crucial to the success of every KMS. IT enables knowledge management by providing the enterprise architecture on which it is

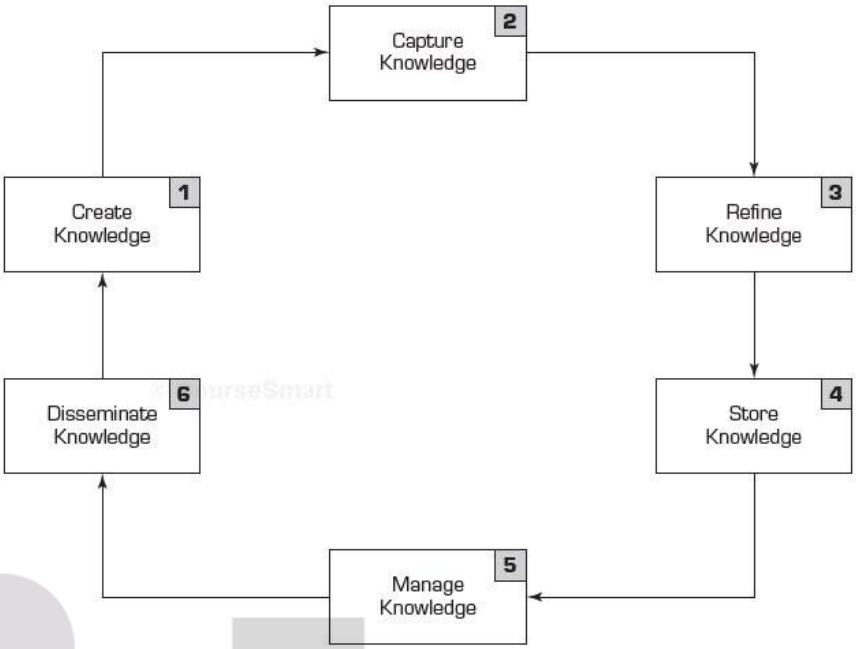

FIGURE 11.5 The Knowledge Management Cycle

built. KMS are developed using three sets of technologies: communication, collaboration, and storage and retrieval.

Communication technologies allow users to access needed knowledge and to communicate with each other—especially with experts. E-mail, the Internet, corporate intranets, and other Web-based tools provide communication capabilities. Even fax machines and telephones are used for communication, especially when the practice approach to knowledge management is adopted.

Collaboration technologies provide the means to perform groupwork. Groups can work together on common documents at the same time (i.e., synchronous) or at different times (i.e., asynchronous); they can work in the same place or in different places. Collaboration technologies are especially important for members of a community of practice working on knowledge contributions. Other collaborative computing capabilities, such as electronic brainstorming, enhance groupwork, especially for knowledge contribution. Additional forms of groupwork involve experts working with individuals trying to apply their knowledge; this requires collaboration at a fairly high level. Other collaborative computing systems allow an organization to create a virtual space so that individuals can work online anywhere and at any time (see Van de Van, 2005).

Storage and retrieval technologies originally meant using a database management system (DBMS) to store and manage knowledge. This worked reasonably well in the early days for storing and managing most explicit knowledge—and even explicit knowledge about tacit knowledge. However, capturing, storing, and managing tacit knowledge usually requires a different set of tools. Electronic document management systems and specialized storage systems that are part of collaborative computing

TABLE 11.3 Knowledge Management Technologies and Web Impacts

Knowledge Management	Web Impacts	Impacts on the Web
Communication	Consistent, friendly graphical user interface (GUI) for client units Improved communication tools Convenient, fast access to knowledge and knowledgeable individuals Direct access to knowledge on servers	Knowledge captured and shared is used in improving communication, communication management, and communication technologies.
Collaboration	Improved collaboration tools Enables anywhere/anytime collaboration Enables collaboration between companies, customers, and vendors Enables document sharing Improved, fast collaboration and links to knowledge sources Makes audio- and videoconferencing a reality, especially for individuals not using a local area network	Knowledge captured and shared is used in improving collaboration, collaboration management, and collaboration technologies (i.e., GSS).
Storage and retrieval	Consistent, friendly GUI for clients Servers provide for efficient and effective storage and retrieval of knowledge	Knowledge captured and shared is utilized in improving data storage and retrieval systems, database management/knowledge repository management, and database and knowledge repository technologies.

systems fill this void. These storage systems have come to be known as knowledge repositories.

We describe the relationship between these knowledge management technologies and the Web in Table 11.3.

Technologies That Support Knowledge Management

Several technologies have contributed to significant advances in knowledge management tools. Artificial intelligence, intelligent agents, knowledge discovery in databases, eXtensible Markup Language (XML), and Web 2.0 are examples of technologies that enable advanced functionality of modern KMS and form the basis for future innovations in the knowledge management field. Following is a brief description of how these technologies are used in support of KMS.

ARTIFICIAL INTELLIGENCE In the definition of knowledge management, artificial intelligence (AI) is rarely mentioned. However, practically speaking, AI methods and tools are embedded in a number of KMS, either by vendors or by system developers. AI methods can assist in identifying expertise, eliciting knowledge automatically and semi-automatically, interfacing through natural language processing, and intelligently searching through intelligent agents. AI methods—notably expert systems, neural networks, fuzzy logic, and intelligent agents—are used in KMS to do the following:

- Assist in and enhance searching knowledge (e.g., intelligent agents in Web searches)
- Help establish knowledge profiles of individuals and groups
- Help determine the relative importance of knowledge when it is contributed to and accessed from the knowledge repository
- Scan e-mail, documents, and databases to perform knowledge discovery, determine meaningful relationships, glean knowledge, or induce rules for expert systems
- Identify patterns in data (usually through neural networks)
- Forecast future results by using existing knowledge
- Provide advice directly from knowledge by using neural networks or expert systems
- Provide a natural language or voice command–driven user interface for a KMS

INTELLIGENT AGENTS Intelligent agents are software systems that learn how users work and provide assistance in their daily tasks. There are other kinds of intelligent agents as well (see Chapter 14). Intelligent agents can help in KMS in a number of ways. Typically, they are used to elicit and identify knowledge. The following are some examples:

- IBM (**ibm.com**) offers an intelligent data-mining family, including Intelligent Decision Server (IDS), for finding and analyzing massive amounts of enterprise data.
- Gentia (Planning Sciences International, **gentia.com**) uses intelligent agents to facilitate data mining with Web access and data warehouse facilities.

Combining intelligent agents with enterprise knowledge portals is a powerful technique that can deliver to users exactly what they need to perform their tasks. The intelligent agent learns what the user prefers to see and how the user organizes it. Then the intelligent agent takes over to provide that information at the desktop, just as a good administrative assistant would.

KNOWLEDGE DISCOVERY IN DATABASES **Knowledge discovery in databases (KDD)** is a process used to search for and extract useful information from volumes of documents and data. It includes tasks such as knowledge extraction, data archaeology, data exploration, data pattern processing, data dredging, and information harvesting. All these activities are conducted automatically and allow quick discovery, even by nonprogrammers. Data and document mining is ideal for eliciting knowledge from databases, documents, e-mail, and so on. Data are often buried deep within very large databases, data warehouses, text documents, or knowledge repositories, all of which may contain data, information, and knowledge gathered over many years. (For more on data mining, see Chapter 7.)

AI methods are useful data-mining tools that include automated knowledge elicitation from other sources. Intelligent data mining discovers information within databases, data warehouses, and knowledge repositories that queries and reports cannot effectively reveal. Data-mining tools find patterns in data and may even (automatically) infer rules from them. Patterns and rules can be used to guide decision making and forecast the

effects of decisions. KDD can also be used to identify the meaning of data or text, using knowledge management tools that scan documents and e-mail to build an expertise profile of a firm's employees. Data mining can speed up analysis by providing needed knowledge.

Extending the role of data mining and knowledge discovery techniques for knowledge externalization, Bolloju et al. (2002) proposed a framework for integrating knowledge management into enterprise environments for next-generation decision support systems (DSS). Their framework includes model marts and model warehouses where **model marts** are analogous to data marts and **model warehouses** are analogous to data warehouses (refer to Chapter 8). They act as repositories of knowledge created by using knowledge-discovery techniques on past decision instances stored in data marts and data warehouses. The model marts and model warehouses capture operational and historical decision models, similar to the data in data marts and data warehouses. For example, a model mart can store decision rules corresponding to problem-solving knowledge of different decision makers in a particular domain, such as loan approvals in a banking environment.

This integrated framework accommodates different types of knowledge transformations. Systems built around this framework are expected to enhance the quality of support provided to decision makers; support knowledge management functions such as acquisition, creation, exploitation, and accumulation; facilitate discovery of trends and patterns in the accumulated knowledge; and provide means for building up organizational memory.

EXTENSIBLE MARKUP LANGUAGE (XML) eXtensible Markup Language (XML) enables standardized representations of data structures so that data can be processed appropriately by heterogeneous systems without case-by-case programming. This method suits e-commerce applications and supply-chain management (SCM) systems that operate across enterprise boundaries. XML can not only automate processes and reduce paperwork, it can also unite business partners and supply chains for better collaboration and knowledge transfer. XML-based messages can be taken from back-end repositories and fed out through the portal interface and back again. A portal that uses XML allows the company to communicate better with its customers, linking them in a virtual demand chain where changes in customer requirements are immediately reflected in production plans. Wide adoption of XML can pretty much solve the problem of integrating data from disparate sources. Due to its potential to tremendously simplify systems integration, XML may become the universal language that all portal vendors embrace (see Ruber, 2001).

WEB 2.0 Recent years have seen a shift in how people use the World Wide Web. The Web has evolved from a tool for disseminating information and conducting business to a platform for facilitating new ways of information sharing, collaboration, and communication in the digital age. A new vocabulary has emerged, as mashups, social networks, media-sharing sites, RSS, blogs, and wikis have come to characterize the genre of interactive applications collectively known as Web 2.0. These technologies are expected to give knowledge management a strong boost by making it easy and natural for everyone to share knowledge over the Web.

In a recent blog posting, Davenport (2008) characterized Web 2.0 (and its reflection to the enterprise world, Enterprise 2.0) as "new, new knowledge management." One of the bottlenecks for knowledge management practices has been the difficulty for nontechnical people to natively share their knowledge. Therefore, the ultimate value of Web 2.0 is its ability to foster greater responsiveness, better knowledge capture and sharing, and ultimately, more effective collective intelligence.

Section 11.6 Review Questions

1. Describe the KMS cycle.
2. List and describe the components of KMS.
3. Describe how AI and intelligent agents support knowledge management.
4. Relate XML to knowledge management and to knowledge portals.

11.7 KNOWLEDGE MANAGEMENT SYSTEMS IMPLEMENTATION

The challenge with KMS is to identify and integrate the three essential components—communication technologies, collaboration technologies, and storage and retrieval technologies—to meet the knowledge management needs of an organization. The earliest KMS were developed with networked technology (i.e., intranets), collaborative computing tools (i.e., groupware), and databases (for the knowledge repository). They were constructed from a variety of off-the-shelf IT components. Many organizations, especially large management consulting firms such as Accenture and J.D. Edwards, developed their knowledge architecture with a set of tools that provided the three technology types. Collaborative computing suites such as Lotus Notes/Domino and GroupSystems OnLine provide many KMS capabilities. Other systems were developed by integrating a set of tools from a single or multiple vendors. For example, J.D. Edwards (an Oracle company) used a set of loosely integrated Microsoft tools and products to implement its Knowledge Garden KMS, as did KPMG. In the early 2000s, KMS technology evolved to integrate the three components into a single package. These packages include enterprise knowledge portals and knowledge management suites.

Knowledge Management Products and Vendors

Technology tools that support KM are called **knowware**. Most knowledge management software packages include one or more of the following tools: collaborative computing tools, knowledge servers, enterprise knowledge portals, electronic document management systems, knowledge harvesting tools, search engines, and knowledge management suites. Many packages provide several tools because they are necessary in an effective KMS. For example, most electronic document management systems also include collaborative computing capabilities.

KMS can be purchased in whole or in part from one of numerous software development companies and enterprise information system (EIS) vendors, they can be acquired through major consulting firms, or they can be outsourced to an application service provider (ASP). All three alternatives are discussed later in this chapter. *KMWorld* publishes a "buyers' guide" in every April edition.

SOFTWARE DEVELOPMENT COMPANIES AND EIS VENDORS Software development companies and EIS vendors offer numerous knowledge management packages, from individual tools to comprehensive knowledge management suites. The variety of knowware that is readily available on the market allows companies to find tools that meet their unique KM needs. We next review some software packages and their vendors in each of the seven knowware categories identified earlier.

Collaborative Computing Tools Collaboration tools, or groupware, were the first tools used to enhance tacit knowledge transfer within an organization. One of the earliest collaborative computing systems, GroupSystems, provides many of the tools that support groupwork, including tools for electronic brainstorming and idea categorization. Lotus Notes/Domino provides an enterprise-wide collaborative environment. Other collaboration tools include MeetingPlace (Latitude), QuickPlace (Lotus Development Corp.), eRoom (eRoom Technology Inc.), Groove Networks (**groove.net**), and Microsoft Office Live Meeting (Microsoft). For more details, see Chapter 10.

KNOWLEDGE SERVERS A knowledge server contains the main knowledge management software, including the knowledge repository, and provides access to other knowledge, information, and data. Examples of knowledge servers include the Hummingbird Knowledge Server, the Intraspect Software Knowledge Server, the Hyperwave Information Server, the Sequoia Software XML Portal Server, and Autonomy's Intelligent Data Operating Layer (IDOL) Server. Autonomy's IDOL Server connects people to content, content to content, and people to people through modules that enable organizations to integrate various personalization, collaboration, and retrieval features. The server provides a knowledge repository—a central location for searching and accessing information from many sources, such as the Internet, corporate intranets, databases, and file systems—thereby enabling the efficient distribution of time-sensitive information. The server seamlessly extends and integrates with the company's e-business suite, allowing rapid deployment applications that span the enterprise and can even leverage AI-assisted technology to harvest knowledge assets.

Enterprise Knowledge Portals **Enterprise knowledge portals (EKP)** are the doorways into many KMS. They have evolved from the concepts underlying EIS, GSS, Web browsers, and DBMS. Using EKP is an ideal way to configure a KMS. Most EKP combine data integration, reporting mechanisms, and collaboration, while a server handles document and knowledge management. An enterprise information portal is a virtual place on a network of online users. The portal aggregates each user's total information needs: data and documents, e-mail, Web links and queries, dynamic feeds from the network, and shared calendars and task lists.

When enterprise information portals first entered the market, they did not have knowledge management features. Now most do; hence, they are now called EKP. Leading portal vendors include Autonomy, Corechange, DataChannel, Dataware, Epicentric, Glyphica, Intraspect, Hummingbird, InXight, KnowledgeTrack, IBM/Lotus, Knowmadic, OpenText, Plumtree, Portera, Sequoia Software, Verity, and Viador. Database vendors such as Microsoft, Oracle, and Sybase also sell knowledge portals.

The KnowledgeTrack Knowledge Center offers integrated business-to-business functions and can scale from dot-coms to large enterprises. Knowledge Center can be built into the enterprise architecture instead of simply sitting on top, the way most intranet portals do. The Knowledge Center integrates with external data sources, including enterprise resource planning (ERP), online analytical processing (OLAP), and customer relationship management (CRM) systems. IT also supports communities of practice and enables them for large-project management, allowing information to be shared among all the extended enterprise value chains.

Electronic Document Management (EDM) **Electronic document management (EDM)** systems use the document in electronic form as the collaborative focus of work. EDM systems allow users to access needed documents, generally via a Web browser over a corporate intranet. EDM systems enable organizations to better manage documents and workflow for smoother operations. They also allow collaboration on document creation and revision.

Many KMS use an EDM system as the knowledge repository. There is a natural fit in terms of the purpose and benefits of the two. Pfizer uses a large-scale document management system to handle the equivalent of truckloads of paper documents of drug approval applications passed between Pfizer and the Food & Drug Administration (FDA), its regulating agency. This EDM system dramatically cut the time required for FDA submission and review, making Pfizer more competitive in getting new and effective drugs to market (Blodgett, 2000).

Systems such as DocuShare (Xerox Corporation) and Lotus Notes (Lotus Development Corporation) allow direct collaboration on a common document. Some other EDM systems include EDMS (Documentum, Inc.), Enterprise Work Management (Eastman Software, Inc.), FYI (Identitech), The Discovery Suite (FileNet Corp.), Livelink

(Open Text Corp.), PageKeeper Pro (Caere Corp.), Pagis Pro (ScanSoft, Inc.), Xpedio (IntraNet Solutions), and CaseCentral.com (Document Repository, Inc.).

A new approach to EDM, called **content management systems (CMS)**, is changing the way documents and their content are managed. A CMS produces dynamic versions of documents and automatically maintains the "current" set for use at the enterprise level. With the explosion of Web-based materials, organizations need a mechanism to provide content that is consistent and accurate across the enterprise. EDM systems, EKP, and other CMS fill that need. The goal is to provide large numbers of knowledge workers with access to large amounts of unstructured text (see Sullivan, 2001). An IDC survey of attendees at the *KMWorld* 2001 Conference and Exposition indicated that 63 percent of all respondents had or planned to implement CMS, while 59 percent rated CMS as very to critically important (see Feldman, 2002). Also see Bankes (2003) and Lamont (2003b).

A subset of CMS is business rules management. New software tools and systems, such as Ilog JRules and Blaze Advisor, have been developed to handle these smaller chunks of content.

Knowledge Harvesting Tools Tools for capturing knowledge unobtrusively are helpful because they allow a knowledge contributor to be minimally (or not at all) involved in the knowledge-harvesting efforts. Embedding this type of tool in a KMS is an ideal approach to knowledge capture. Tacit Knowledge Systems' Knowledge-mail is an expertise-location software package that analyzes users' outgoing e-mail to parse subject expertise. It maintains a directory of expertise and offers ways to contact experts while maintaining privacy controls for them. Autonomy's ActiveKnowledge performs a similar analysis on e-mail and other standard document types. Intraspect Software's Knowledge Server monitors an organization's group memory; captures the context of its use, such as who used it, when, for what, how it was combined with other information, and what people said about it, and then makes the information available for sharing and reuse. KnowledgeX by KnowledgeX, Inc., and a number of other products provide similar functionality.

Search Engines Search engines perform one of the essential functions of knowledge management—locating and retrieving necessary documents from vast collections accumulated in corporate repositories. Companies such as Google, Verity, and Inktomi offer a wide selection of search engines capable of indexing and cataloging files in various formats as well as of retrieving and prioritizing relevant documents in response to user queries.

Knowledge Management Suites Knowledge management suites are complete out-of-the-box knowledge management solutions. They integrate the communications, collaboration, and storage technologies into a single convenient package. A knowledge management suite must access internal databases and other external knowledge sources, so some integration is required to make the software truly functional. IBM/Lotus offers an extensive range of knowledge management products, including the Domino platform, QuickPlace and Sametime, Discovery Server and Learning Space, and the WebSphere portal. See Application Case 11.5 to learn how Commerce Bank implemented a KMS based on the IBM/Lotus platform. Several vendors also provide fairly comprehensive sets of tools for knowledge management initiatives, including Dataware Knowledge Management Suite and KnowledgeX by KnowledgeX, Inc. Autonomy Knowledge Management Suite offers document categorization and workflow integration. Microsoft provides central components of knowledge management solutions and is working on developing an encompassing knowledge management framework. Some EIS vendors, such as SAP, PeopleSoft, and Oracle, are developing knowledge management–related technologies as a platform for business applications. Siebel Systems is repositioning itself as a business-to-employee knowledge management platform. Using a knowledge management suite is a powerful approach to developing a KMS because it has one user interface and one data repository, and it is from one vendor.

APPLICATION CASE 11.5

Knowledge Management: You Can Bank on It at Commerce Bank

Commerce Bank is a $15.4 billion financial institution that is quickly growing to become a dominant player in the financial services market of Philadelphia and southern New Jersey. During its 30 years of existence, it has developed a network of 214 branches and has made ambitious plans for continuous growth. Commerce Bank calls itself "America's Most Convenient Bank." It lives up to that name by maintaining a strong banking network and by empowering each branch to make business decisions in an effort to better meet the needs of its customers.

While undergoing explosive growth, Commerce Bank encouraged its associates to learn all about its customers and the right ways to service them. However, the company realized that its most important asset, knowledge, was locked away in the file cabinets and in the heads of its associates. To support this initiative, Commerce Bank needed to tap into that knowledge and find a way to train employees consistently and conveniently across the entire branch network.

The first step for new employees is Commerce University, a boot camp where they are instilled with the fundamentals of customer service. However, the program covers only a few of the range of issues that an associate might encounter.

The need for knowledge management at Commerce Bank was apparent. Jack Allison, vice president of systems development, said,

> We had folks in administration that could spend 70 percent of their time answering calls and clarifying answers for branches. At times, we could wait weeks or months for the right answer to certain questions. Knowing that training may not give answers for every scenario, we needed to give associates a tool that could help them find any answer to any topic at any time. We have so many regulations and products; we needed a way to give our employees all the knowledge to process these.

Commerce Bank envisioned a solution—a workflow-based KMS that could provide instant answers to questions for the bank's employees and online customers. To make this vision a reality, Commerce chose to develop a system based on IBM's Lotus Notes, which the bank has been using since 1995. Using IBM's Domino server, the Lotus Notes client, and an application development tool kit, Commerce Bank created a full-fledged KMS, called Wow Answer Guide.

Introduced in 2000, Wow Answer Guide provides a central repository of knowledge about all bank transactions. It helps employees learn a process and respond to customer inquiries, and it stores information electronically. In addition, the system allows employees to register for the bank's continuing education courses.

The complete Wow Answer Guide contains more than 400 applications, and Commerce plans to add even more, such as a CRM system. The flexibility of the platform simplifies the application-development process and allows the addition of new features and the expansion of functionality with minimal investments of time and effort.

"[The Wow Answer Guide] is especially good for the green associate or veteran who is still learning how to process a new product," said Allison. "We don't want our associates on a scavenger hunt to get the correct information."

Commerce Bank realized that knowledge management would be beneficial not only to the bank's employees but also to its clients. "We wanted to put information in our customers' hands so they could conduct [online] transactions with confidence," said Allison. In the summer of 2000, Commerce Bank deployed a new version of Wow Answer Guide that empowered the bank's online customers.

Knowledge management at Commerce Bank proved to be an effective investment. According to Allison, the application has saved the bank $20,000 per week, or approximately $1 million a year. In fact, the bank achieved a return on investment within a month of launching Wow Answer Guide.

By drawing on the power of the Domino platform, Commerce Bank created workflow-based applications that streamline internal knowledge sharing and route data and information to the appropriate employees within the organization. This dramatically reduces the completion time for approval-intensive transactions, improves the bank's capacity, and minimizes labor costs.

Sources: Adapted from D. Amato-McCoy, "Commerce Bank Manages Knowledge Profitably," *Bank Systems & Technology,* January 2003; and "Knowledge Infusion Helps Commerce Bank Experience Big Pay Off with Talent Management Initiative," October 19, 2005, **onlypun-jab.com/money/fullstory-insight-money+finance-newsID-9368.html** (accessed April 2006).

KNOWLEDGE MANAGEMENT CONSULTING FIRMS All the major consulting firms (e.g., Accenture, Cap Gemini Ernst & Young, Deloitte & Touche, KPMG, PWC) have massive internal knowledge management initiatives. Usually, these become products after they succeed internally and provide assistance in establishing KMS and measuring their effectiveness. Consulting firms also provide some direct, out-of-the-box proprietary systems for vertical markets. Most of the major management consulting firms define their knowledge management offerings as services. For more on consulting firm activities and products, see McDonald and Shand (2000).

KNOWLEDGE MANAGEMENT ASPS ASPs have evolved as a form of KMS outsourcing on the Web. There are many ASPs for e-commerce on the market. For example, Communispace is a high-level ASP collaboration system that focuses on connecting people to people (not just people to documents) to achieve specific objectives, regardless of geographic, time, and organizational barriers. As a hosted ASP solution, Communispace is easy to rapidly deploy within organizations. Unlike conventional KMS that organize data and documents or chat rooms, where people simply swap information, Communispace contains a rich assortment of interactions, activities, and tools that connect people to the colleagues who can best help them make decisions, solve problems, and learn quickly. Communispace is designed to build trust online; it attempts to make a community self-conscious about taking responsibility for its actions and knowledge. Its climate component helps participants measure and understand how people are feeling about the community. Its Virtual Café gives dispersed employees a way to meet and learn about each other through pictures and profiles.

A recent trend among ASPs is to offer a complete KM solution, including a knowledge management suite and the consulting to set it up, as Communispace does.

Integration of KMS with Other Business Information Systems

Because a KMS is an enterprise system, it must be integrated with other enterprise and information systems in an organization. Obviously, when it is designed and developed it cannot be perceived as an add-on application. It must be truly integrated into other systems. Through the structure of the organizational culture (which is changed, if necessary), a KMS and its activities can be directly integrated into a firm's business processes. For example, a group involved in customer support can capture its knowledge to provide help on customers' difficult problems. In this case, help-desk software would be one type of package to integrate into a KMS, especially into the knowledge repository.

Because a KMS can be developed on a knowledge platform/server consisting of communication, collaboration, and storage technologies, and because most firms already have many such tools and technologies in place, it is often possible to develop a KMS in the organization's existing tools (e.g., Lotus Notes/Domino). Or, an EKP can provide universal access and an interface into all of an individual's relevant corporate information and knowledge. In this case, the KMS effort would provide the linkage for everyone into the entire EIS.

INTEGRATION OF KMS WITH DSS/BI SYSTEMS KMS typically do not involve running models to solve problems. This is typically done in DSS/BI systems. However, because a KMS provides help in solving problems by applying knowledge, part of the solution may involve running models. A KMS can integrate into a set of models and data, and it can activate them if a specific problem calls for it. Also, the knowhow and best practice application of models can be stored in a KMS.

INTEGRATION OF KMS WITH AI KM has a natural relationship with AI methods and software, although knowledge management, strictly speaking, is not an AI method. KM and AI can be integrated in a number of ways. For example, if the knowledge stored in a KMS is

to be represented and used as a sequence of if-then-else rules, an expert system becomes part of the KMS (see Rasmus, 2000). An expert system could also assist a user in identifying how to apply a chunk of knowledge in the KMS. Natural language processing assists the computer in understanding what a user is searching for. Artificial neural networks help to understand text to determine the applicability of a specific chunk of knowledge as it applies to a particular problem. They are also used to enhance search engines. The most common integration of AI and KM is in identifying and classifying expertise by examining e-mail messages and documents. These include AI-based tools, such as ActiveNet and Knowledge-mail from Tacit Software, Inc. (**tacit.com**), and Categorizer from Inxight Software (**inxight.com**).

Much work is being done in the field of AI relating to knowledge engineering; tacit-to-explicit knowledge transfer; and knowledge identification, understanding, and dissemination. Companies are attempting to realign these technologies and the resultant products with knowledge management. The AI technologies most often integrated with KM are intelligent agents, expert systems, neural networks, and fuzzy logic. Several specific methods and tools are described earlier in this chapter.

INTEGRATION OF KMS WITH DATABASES AND INFORMATION SYSTEMS Because a KMS uses a knowledge repository, sometimes constructed out of a database system or an EDM system, it can automatically integrate to this part of the firm's information system. As data and information updates are made, the KMS can use them. As described earlier in this chapter, KMS also attempt to glean knowledge from documents and databases through AI methods, in a process known as KDD. This knowledge is then represented textually within the knowledge repository described earlier.

INTEGRATION OF KMS WITH CRM SYSTEMS CRM systems help users in dealing with customers. One aspect is the help-desk notion described earlier. But CRM goes much deeper than that. It can develop usable profiles of customers and predict their needs so that an organization can increase sales and better serve its clients. A KMS can certainly provide tacit knowledge to people who use CRM directly in working with customers.

INTEGRATION WITH SCM SYSTEMS The supply chain is often considered to be the logistics end of a business. If products do not move through the organization and go out the door, the firm will fail. It is therefore important to optimize the supply chain and manage it properly. A new set of software called *SCM systems* attempts to do so. SCM can benefit from integration with KMS because there are many issues and problems in the supply chain that require the company to combine tacit and explicit knowledge. Accessing such knowledge directly improves supply-chain performance.

INTEGRATION OF KMS WITH CORPORATE INTRANETS AND EXTRANETS Communication and collaboration tools and technologies are necessary for KMS to function. A KMS is not simply integrated with the technology of intranets and extranets; it is typically developed on them as the communications platform. Extranets are specifically designed to enhance the collaboration of a firm with its suppliers and sometimes with customers. If a firm can integrate its KMS into its intranets and extranets, not only will knowledge flow more freely, both from a contributor and to a user (either directly or through a knowledge repository), but the firm can also capture knowledge directly, with little user involvement, and can deliver it when the system thinks that a user needs knowledge.

Section 11.7 Review Questions

1. Define *knowware*.
2. Describe the major categories of knowledge management tools.

3. Define *EKP*.
4. Define *EDM* and relate it to knowledge management and to CMS.
5. Describe tools for knowledge harvesting.
6. List the major systems that are frequently integrated with KMS.

11.8 ROLES OF PEOPLE IN KNOWLEDGE MANAGEMENT

Managing a KMS requires great effort. As with any other IT, getting it started, implemented, and deployed requires a champion's effort. Many issues of management, people, and culture must be considered to make a KMS a success. In this section, we address those issues. Managing the knowledge repository typically requires a full-time staff (similar to a reference library staff). This staff examines, structures, filters, catalogs, and stores knowledge so that it is meaningful and can be accessed by the people who need it. The staff assists individuals in searching for knowledge and performs environmental scanning: If they identify specific knowledge that an employee or a client might need, they send it directly to whoever needs it, thus adding value to the organization. (This is standard procedure for Accenture knowledge management personnel.) Finally, the knowledge repository staff may create communities of practice (see the case at the end of the chapter) to gather individuals with common knowledge areas to identify, filter, extract, and contribute knowledge to a knowledge repository.

Most of the issues concerning the success, implementation, and effective use of a KMS are people issues. And because a KMS is an enterprise-wide effort, many people are involved. They include the chief knowledge officer (CKO), the CEO, the other officers and managers of the organization, members and leaders of communities of practice, KMS developers, and KMS staff. Each person or group has an important role in either the development, management, or use of a KMS. By far, the CKO has the most visible role in a KMS effort, but the system cannot succeed unless the roles of all the players are established and understood. And the team must consist of the right people, possessing the appropriate level of experience, to take on the various roles (see Riege, 2005).

The Chief Knowledge Officer

Knowledge management projects that involve establishing a knowledge environment conducive to the transfer, creation, or use of knowledge attempt to build cultural receptivity. These attempts are centered on changing the behavior of the firm to embrace the use of knowledge management. Behavior-centric projects require a high degree of support and participation from the senior management of the organization to facilitate their implementation. Most firms developing KMS have created a knowledge management officer—a **chief knowledge officer (CKO)**—at the senior level. The objectives of the CKO's role are to maximize the firm's knowledge assets, design and implement KM strategies, effectively exchange knowledge assets internally and externally, and promote system use. The CKO is responsible for developing processes that facilitate knowledge transfer.

According to Duffy (1998), a CKO must do the following:

- Set knowledge management strategic priorities.
- Establish a knowledge repository of best practices.
- Gain a commitment from senior executives to support a learning environment.
- Teach information seekers how to ask better and smarter questions.
- Establish a process for managing intellectual assets.
- Obtain customer satisfaction information in near real time.
- Globalize knowledge management.

The CKO is responsible for defining the area of knowledge within the firm that will be the focal point, based on the firm's mission and objectives (see Davis, 1998). The CKO is

responsible for standardizing the enterprise-wide vocabulary and controlling the knowledge directory. This is critical in areas that must share knowledge across departments, to ensure uniformity. The CKO must get a handle on the company's repositories of research, resources, and expertise, including where they are stored and who manages and accesses them (e.g., perform a knowledge audit). Then the CKO must encourage pollination among disparate workgroups with complementary resources (see McKeen and Staples, 2003).

The CKO is responsible for creating an infrastructure and cultural environment for knowledge sharing. He or she must assign or identify (and encourage/motivate) the knowledge champions within the business units. The CKO's job is to manage the content the champions' groups produce, continually add to the knowledge base, and encourage colleagues to do the same. Successful CKOs should have the full and enthusiastic support of their managers and of top management. Ultimately, the CKO is responsible for the entire knowledge management project while it is under development and then for management of the system and the knowledge after it is deployed.

A CKO needs a range of skills to make knowledge management initiatives succeed. These attributes are indispensable, according to CKOs and consultants (see Flash, 2001):

- Interpersonal communication skills to convince employees to adopt cultural changes
- Leadership skills to convey the knowledge management vision and passion for it
- Business acumen to relate knowledge management efforts to efficiency and profitability
- Strategic thinking skills to relate knowledge management efforts to larger goals
- Collaboration skills to work with various departments and persuade them to work together
- The ability to institute effective educational programs
- An understanding of IT and its role in advancing knowledge management

The CEO, Officers, and Managers of the Organization

Briefly, the CEO is responsible for championing a knowledge management effort. He or she must ensure that a competent and capable CKO is found and that the CKO can obtain all the resources (including access to people with knowledge sources) needed to make the project a success. The CEO must also gain organization-wide support for contributions to and use of the KMS. The CEO must also prepare the organization for the cultural changes that are about to occur. Support is the critical responsibility of the CEO. The CEO is the primary change agent of the organization.

The officers generally must make available to the CKO the resources needed to get the job done. The chief financial officer (CFO) must ensure that the financial resources are available. The chief operating officer (COO) must ensure that people begin to embed knowledge management practices into their daily work processes. There is a special relationship between the CKO and chief information officer (CIO). Usually, the CIO is responsible for the IT vision of the organization and for the IT architecture, including databases and other potential knowledge sources. The CIO must cooperate with the CKO in making these resources available. KMS are expensive propositions, and it is wise to use existing systems if they are available and capable.

Managers must also support the knowledge management effort and provide access to sources of knowledge. In many KMS, managers are an integral part of the communities of practice.

Communities of Practice

The success of many KMS has been attributed to the active involvement of the people who contribute to and benefit from using the knowledge. Consequently, communities of practice have appeared within organizations that are serious about their knowledge

management efforts. A **community of practice (COP)** is a group of people in an organization with a common professional interest. Ideally, all the KMS users should each be in at least one COP. Properly creating and nurturing COP is one key to KMS success (see Liedtka, 2002; and Wenger, 2002).

COP are where the organizational culture shift really happens when developing and deploying KMS. A supportive culture must be developed for a KMS to succeed (see Wenger, 2002; and Wenger et al., 2002). In Application Case 11.6, we describe how Xerox Corp. successfully generated improved practices and cost savings through COP.

APPLICATION CASE 11.6

Online Knowledge Sharing at Xerox

In the early 1990s, Xerox had a nationwide database that contained information that could be used to fix its copiers, fax machines, and high-speed printers. However, the information was not readily available to the 25,000 service and field employees and engineers who repaired the machines at customer sites. Satisfaction with customer service was low.

The engineers at Xerox's Palo Alto Research Center (PARC) spent 6 months observing repair personnel, watching how they worked, noting what their frustrations were, and identifying what kind of information they needed. They determined that the repair personnel needed to share their knowledge with their peers. PARC engineers developed Eureka, an online knowledge-sharing system created to assist the service people with time-consuming and complicated repair problems.

Ray Everett, program manager for Eureka, described the powerful impact the program has had on service, "You went from not knowing how to fix something to being able to get the answer instantly. Even better, you could share any solutions you found with your peers around the globe within a day, as opposed to the several weeks it used to take."

Since its inception in 1996, Eureka has been implemented in 71 countries. It has helped solve 350,000 problems and has saved $3 million to $4 million in parts and labor every year. The system is available to all of Xerox's service engineers via notebook computers and is accessed through the Internet. Product fixes (50,000 of them), documentation updates, and product-update bulletins are delivered over the Web. Individual service employees and engineers can enter into the system possible new solutions to problems. A solution appears in Eureka, giving credit to the author and noting the service employee's country of origin. An alert about a new solution is sent to validators who test the solution; if it works consistently, it is sent to all engineers via Eureka updates.

Since 2004, Eureka has been designed to work over wireless Internet connections. Eureka is a constantly evolving and growing system that connects and shares the collective knowledge of Xerox's service force.

One of Eureka's guiding principles is, "We should never create the same solution twice. If a solution already exists, it should be used rather than recreating a new solution. In addition, we should focus on continuously improving existing solutions." Eureka! It works!

Sources: Compiled from S. Barth, "Knowledge as a Function of X," *Knowledge Management,* February 2000; and S. L. Roberts-Witt, "The @HP Way," *Portals Magazine,* November 2002.

In a sense, a COP owns the knowledge that it contributes because it manages the knowledge on its way into the system and must approve modifications to it. The COP is responsible for the accuracy and timeliness of the knowledge it contributes and for identifying its potential use. A number of researchers have investigated how successful COP form and function. In Table 11.4, we illustrate the many ways that COP add value to an organization through KM efforts. Basically, COP make organizations run smoothly because they enable knowledge flow. Informed people make better decisions. People who are involved are happier at work. Wenger et al. (2002) recommended seven design

TABLE 11.4 How Communities of Practice Add Value to an Organization

Name of Added Value	Attributes That Create Value
Creation of higher-quality knowledge	• Diversity in membership and less emphasis on hierarchical status reduce the likelihood of groupthink.
	• Limited requirements for formal reporting allow people to perform riskier brainstorming.
	• A reflection process at the end of a meeting consolidates learning.
Fewer surprises and plan revisions	• Broad participation diffuses knowledge across business units.
	• Openness of interaction format results in effective conflict resolution.
Greater capacity in dealing with unstructured problems	• Work occurs under a set of superordinate goals, not task goals.
	• The sponsoring organization accepts a self-evolving community role.
	• Knowledge leaders can emerge based on issues instead of by assignment to a team or roles within a team.
More effective knowledge sharing among business and corporate staff units	• Voluntary participation implies higher motivation, leading to faster, deeper learning internalization.
	• Trust increases due to indeterminate life span and long-term relationships.
Improved likelihood of implementing joint goals	• The community yields greater external validity because it exists externally to the formal organizational structure.
	• The community has more influence than an individual, given the organizational level of the community members.
More effective individual development and learning	• Group learning is more effective than individual learning.
	• The community's development process embodies learning opportunities through practice.

Source: Based on Table 5.2 in "Strategic Community: Adding Value to the Organization," in E. L. Lesser, M. A. Fontaine, and J. A. Slusher (eds.), *Knowledge and Communities,* Butterworth-Heinemann, Woburn, MA, 2000, p. 77.

principles for successful COP. Each of these facilitates knowledge creation and use. We describe them in Technology Insights 11.2.

Storck and Hill (2002) investigated one of the earliest COP at Xerox. When established at Xerox, the COP was a new organizational form. The word *community* captured the sense of responsible, independent action that characterized the group, which continued to function within the standard boundaries of the large organization. Management sponsored the community but did not mandate it. Community members were volunteers. We list and describe the six key principles that support COP at Xerox in Table 11.5. Brailsford (2001) described how Hallmark Cards built its COP and made similar discoveries to those at Xerox. For more on COP, see Barth (2000a), Brown and Duguid (2002), Lesser and Prusak (2002), McDermott (2002), Smith and McKeen (2003), Storck and Hill (2002), and Wenger (2002).

KMS Developers

KMS developers are the team members who actually develop the system. They work for the CKO. Some are organizational experts who develop strategies to promote and manage

TECHNOLOGY INSIGHTS 11.2 Seven Principles for Designing Successful COP

Here are seven ways to encourage vibrant COP in an organization:

1. **Design for evolution.** COP are organic, and many organizational factors influence their direction. Plan carefully. One does not so much manage a community as shepherd it.
2. **Open a dialogue between inside and outside.** Good community design requires an understanding of the community's potential to develop and steward knowledge, but it often takes an outside perspective to help members see possibilities. The COP should not close in on itself.
3. **Invite different levels of participation.** There are typically three main levels of community participation. The first is a small core of people who actively participate in discussions. As the COP matures, this group evolves into the leadership. The next level is the active group. These members attend meetings regularly and participate occasionally in the community forums but not as regularly or as intensely as the core group. A large portion of the COP is peripheral and rarely participates. Do not exclude these people. They often use the knowledge generated. The key to good community participation, and a healthy degree of movement between levels, is to design community activities that allow participants at all levels to feel like full members.
4. **Develop public and private spaces.** The heart of a community is the web of relationships among community members, and private space is necessary to get the relationships to grow.
5. **Focus on value.** Because participation is generally voluntary, a COP must provide value. Communities must create events, activities, and relationships that help their potential value emerge and enable them to discover new ways to harvest it rather than determine expected value in advance.
6. **Combine familiarity and excitement.** Vibrant communities supply divergent thinking and activity. Routine activities provide stability for relationship building.
7. **Create a rhythm for the community.** There is a tempo associated with the members' interactions. This rhythm is the strongest indicator of its life and potential. The COP should contain a balance between large- and small-group sessions and between idea-sharing forums and tool-building projects. The rhythm will evolve with the community, but it is important to find the right one at each stage.

Sources: Compiled from E. Wenger, R. McDermott, and W. M. Snyder, *Cultivating Communities of Practice,* Harvard Business School Press, Boston, 2002; and E. Wenger, R. McDermott, and W. M. Snyder. "It Takes a Community," *CIO,* May 15, 2002.

the organizational culture shift. Others are involved in system software and hardware selection, programming, testing, deployment, and maintenance. Still others are initially involved in training users. Eventually, the training function moves to the KMS staff.

KMS Staff

Enterprise-wide KMS require a full-time staff to catalog and manage the knowledge. This staff is either located at the firm's headquarters or dispersed in knowledge centers throughout the organization. Most large consulting firms have more than one knowledge center.

Earlier in this chapter we described the function of the staff as being similar to that of reference librarians. However, KMS staff actually do much more. Some members are functional area experts who are now cataloging and approving knowledge contributions and pushing the knowledge out to clients and employees whom they believe can use the knowledge. These functional experts may also work in a liaison role with the functional areas of the COP. Others work with users to train them on the system or help them with their searches. Still others work on improving the system's performance by identifying better methods with which to manage knowledge. For example, Cap Gemini Ernst &

TABLE 11.5 The Six Key Principles Supporting Communities of Practice at Xerox

Community Characteristic	Actions
Interaction format	Consists of meetings, collaborative computing, interaction structure, e-mail, etc.
Organizational culture	Leverages common training, experience, and vocabulary.
	Facilitates working around constraints.
Mutual interest	Builds commitment and promotes continuous improvement of processes.
Individual and collective learning	Recognizes and rewards knowledge contribution and use, leverages knowledge, and provides a culture of knowledge sharing.
Knowledge sharing	Embeds knowledge sharing into work practices.
	Reinforces with immediate feedback the value of knowledge sharing.
Community processes and norms	Builds trust and identity.
	Minimizes linkage to the formal control structure.
	Motivates the community to establish its own governance processes.

Source: Based on J. Storck and P. A. Hill, "Knowledge Diffusion Through Strategic Communities," *Sloan Management Review,* Vol. 41, No. 2, Winter 2000.

Young has 250 people managing the knowledge repository and assisting people in finding knowledge at its Center for Business Knowledge. Some staff members disseminate knowledge, and others are liaisons with the 40 practice areas. They codify and store documents in their areas of expertise (see Hansen et al., 1999).

Section 11.8 Review Questions

1. Describe the role of the CKO.
2. What other managers are involved with knowledge management?
3. Describe COP and relate them to knowledge management.
4. What is the importance of COP in organizations?

11.9 ENSURING THE SUCCESS OF KNOWLEDGE MANAGEMENT EFFORTS

Although there are many cases of knowledge management success, there are also many cases of failure. Let's look at the reasons behind success or failure.

Knowledge Management Success Stories

Organizations can gain several benefits from implementing a knowledge management strategy. Tactically, they can accomplish some or all of the following: reduce loss of intellectual capital due to people leaving the company; reduce costs by decreasing the number of times the company must repeatedly solve the same problem and by achieving economies of scale in obtaining information from external providers; reduce redundancy of knowledge-based activities; increase productivity by making knowledge available more quickly and easily; and increase employee satisfaction by enabling greater personal

development and empowerment. The best reason of all may be a strategic need to gain a competitive advantage in the marketplace.

Many factors are necessary for knowledge management to succeed. For example, Gold et al. (2001) described how a knowledge infrastructure consisting of technology, structure, and culture, along with a knowledge process architecture of acquisition, conversion, application, and protection, are essential "preconditions" for effective knowledge management. The situation in an organization must be right in order for a KM effort to succeed. See O'Dell et al. (2003), Smith and McKeen (2003), and Firestone and McElroy (2005) for more KM successes. Technology Insights 11.3 is about an annual study for identifying and recognizing the most admired knowledge enterprises.

A good example of how proper analysis and implementation of knowledge management projects can help a large broadcasting corporation manage their most valuable assets (knowledge, that is) is provided in Application Case 11.7.

TECHNOLOGY INSIGHTS 11.3 MAKE: Most Admired Knowledge Enterprises

MAKE is an annual study administered by Teleos—an independent knowledge management and intellectual capital research firm—in association with the MAKE network to identify the best practitioners of knowledge management. A panel of global *Fortune* 500 senior executives and internationally recognized knowledge management and/or intellectual capital experts collaborate to choose the Global MAKE winners. The panel rates organizations against the MAKE framework of eight key knowledge performance dimensions that are deemed to be the visible drivers of competitive advantage. These eight key knowledge performance dimensions are:

1. Creating a corporate knowledge-driven culture
2. Developing knowledge workers through senior management leadership
3. Fostering innovation
4. Maximizing enterprise intellectual capital
5. Creating an environment for collaborative knowledge sharing
6. Facilitating organizational learning
7. Delivering value based on stakeholder knowledge
8. Transforming enterprise knowledge into stockholder/stakeholder value

The winners of the 11th annual MAKE study were announced in December 2008. For the second year in a row, McKinsey & Company was named the overall Global MAKE winner. Following is the list of all winners of the 2008 Global MAKE competition:

1. McKinsey & Company
2. Google
3. Royal Dutch Shell
4. Toyota
5. Wikipedia
6. Honda
7. Apple
8. Fluor
9. Microsoft
10. PricewaterhouseCoopers
11. Ernst & Young
12. IBM
13. Schlumberger
14. Samsung Group
15. BP
16. Unilever

17. Accenture
18. Tata Group
19. Infosys Technologies
20. APQC

According to Rory Chase, managing director of Teleos, these organizations have been recognized as global leaders in effectively transforming enterprise knowledge into wealth-creating ideas, products, and solutions. They are building portfolios of intellectual capital and intangible assets that will enable them to outperform their competitors now and in the future. Some of the findings of the 2008 Global MAKE study included:

- Knowledge-driven organizations significantly outperform their competitors. For the 10-year period 1997–2007, the total return to shareholders (TRS) for the publicly traded 2008 Global MAKE Winners was over twice that of the *Fortune* 500 company median.
- The capability to innovate and maximize enterprise intellectual capital is seen as *the competitive advantage* across a wide range of business sectors.
- As a result of globalization, most key business sectors will have only three to five global leaders by 2010.

Sources: A. Thomas, "The Global MAKE Awards—2008," Project Management Tips, 2009, **pmtips.net/make-awards-2008** (accessed June 2009); and The MAKE Network, **knowledgebusiness.com** (accessed June 2009).

APPLICATION CASE 11.7

The British Broadcasting Corporation Knowledge Management Success

The British Broadcasting Corporation (BBC) runs on knowledge. When Euan Semple became chief knowledge manager at the BBC, he recognized that the BBC was in fact all about knowledge. Instead of developing a large-scale, expensive KMS, Semple opted to focus on a network-based, conversationally oriented system that matched the way the BBC functions—as a social network. Semple focused on the social network and how he could best make it connect smoothly and effectively. His first tool was the Talk.Gateway bulletin board. By late 2005, 8,000 users (out of 25,000 employees) were performing some 450,000 page views per month.

BBC employees use Talk.Gateway to ask questions and get answers. Knowledge moves rapidly, and Talk.Gateway also generates knowledge. Executives watch it to identify the first signs of problems. In one case, the BBC's director general, Greg Dyke, resigned because of errors in the reporting of the death of an Iraqi arms expert. There was a flood of activity on the bulletin board when this happened.

The next project was Connect, a people finder. People enter their expertise and interests so others can find them. When someone needed to translate a document into Dutch, more than 25 names popped up (zeker!). And, through Connect, COP can and do form. More than 200 interest groups have formed that span the BBC's organizational charts, breaking down silos and spreading knowledge. A blogging server went online next; some of the blogs are by individuals and others are by interest groups. Wikis have been developed as well.

These systems represent a significant shift from conventional information management and afford the possibility of speedy, effective communication among dispersed individuals and groups in modern, complex organizations. These social networking tools enable new, modern forms of collaboration. High-tech and large budgets are not necessary to attain knowledge management success. What is necessary is for the KMS and the organization's culture to have a good fit. At the BBC, it meant connecting people together through effective social networking tools.

Sources: Adapted from D. Weinberger, "The BBC's Low-Tech Knowledge Management," *KMWorld,* September 2005; E. Semple, "Social Networking at the BBC," Online Information 2005 Conference, December 1, 2005; "The Knowledge: Euan Semple," *Inside Knowledge,* Vol. 8, No. 9, June 16, 2005.

While interest in KMS remains strong, few stand-alone KMS applications are available. In many cases, as described earlier, KMS are integrated with other enterprise systems or are modules attached to ERP, BI, or CRM systems. Furthermore, very few companies maintain separate organizational knowledge bases. They keep knowledge in a data warehouse or in knowledge bases of specific applications. A relatively new stand-alone application is known as an *expert location system*.

EXPERT LOCATION SYSTEMS Companies know that IT can be used to find experts. People who need help can post their problem on a corporate intranet and ask for help. Similarly, companies can ask for advice on how to exploit an opportunity. IBM frequently uses this method. Sometimes it obtains hundreds of useful ideas within a few days. It is a kind of brainstorming. The problem with this approach is that it may take days to get answers, if answers are even provided, and the answers may not be from the top experts. Therefore, companies employ expert location systems.

Expert location systems are interactive computerized systems that help employees find and connect with colleagues who have the expertise required for specific problems—whether they are across the country or across the room—in order to solve specific, critical business problems in seconds. Such software is made by companies such as AskMe and Tacit Knowledge Systems, Inc. These systems work by exploring knowledge bases for either an answer to the problem (if it exists there) or to locate qualified experts. The process includes the following steps:

1. An employee submits a question to the expert location system.
2. The software searches its database to see if an answer to the question already exists. If it does, the information (e.g., research reports, spreadsheets) is returned to the employee. If an answer does not exist, the software searches documents and archived communications for an "expert."
3. When a qualified candidate is located, the system asks if he or she is able to answer a question from a colleague. If so, the expert submits a response. If the candidate is unable to answer (perhaps he or she is in a meeting or otherwise indisposed), the person can elect to pass on the question. The question is then routed to the next appropriate candidate until one responds.
4. After the response is sent, it is reviewed for accuracy and sent back to the person who entered the query. At the same time, it is added to the knowledge database. This way, if the question comes up again, it will not be necessary to seek real-time assistance.

Application Case 11.8 demonstrates how an expert location system works for the U.S. government.

APPLICATION CASE 11.8

How the U.S. Department of Commerce Uses an Expert Location System

The U.S. Commercial Service Division at the Department of Commerce (DOC) conducts approximately 200,000 counseling sessions a year, involving close to $40 billion in trade. The division employs many specialists who frequently need to do research or call on experts to answer questions posed by U.S. corporations.

For example, in May 2004 a U.S.–based software company called Brad Anderson, a DOC specialist, for advice. The software company wanted to close a deal with a customer in Poland, but the buyer wanted to charge the U.S. company a 20 percent withholding tax, a tax it attributed to Poland's recent admission into the European Union (EU). Was the tax legitimate?

To find out, Anderson turned to the DOC Insider, an expertise location system (from AskMe). After typing in his question, Anderson first found some documents that were related to his query, but they did not explain the EU tax code completely. Anderson next asked the system to search the 1,700-strong Commercial Service for a live expert, and, within seconds, he was given a list of 80 people in the DOC who might be able to help him. Of those, he chose the six people he felt were most qualified and then forwarded his query.

Before the DOC Insider was in place, Anderson says, it would have taken him about 3 days to find an answer to the question. "You have to make many phone calls and deal with time zones," he said. Thanks to the expert location system, however, he had three responses within minutes and a complete answer within an hour, and the sale went through the following morning. Anderson estimated that he now uses the system for roughly 40 percent of the work he does.

The DOC Insider is an invaluable tool. Anderson said that the tool is vital enough to provide it to other units at the agency. In the first 9 months the system was in place, it saved more than 1,000 labor-hours.

Sources: Compiled from D. D'Agostino, "Expertise Management: Who Knows About This?" *CIO Insight,* July 1, 2004; and P. Fox, "Using IT to Tap Experts' Know-How," March 15, 2004, **computerworld.com/softwaretopics/software/apps/story/0,10801,91174,00.html** (accessed June 2009).

Nowadays, one of the most significant differentiators for successful firms is the way they deal with their customers. As the competition increased, firms looked for the real difference makers, which led to better customer service. Technology Insights 11.4 summarizes the key KM success factors for improved customer service.

TECHNOLOGY INSIGHTS 11.4 Six Keys to KM Success for Customer Service

The role of customer service has probably never been more challenging—yet more critical—for the success (or mere survival) of an organization. Customer service is one of the few real differentiators that businesses can sustain over time. Companies that are winning in today's business environment are the ones providing exceptional customer service by using knowledge to empower contact center agents and foster self-service interactions. Compiled from hundreds of best practices, the following six factors are among the most important for KM implementations:

1. **Quantify value.** Assessing expected and realized return on investment (ROI) before and after the deployment helps justify the initial investment as well as ongoing maintenance of the knowledgebase (KB), while elevating your visibility as a value creator for your business. It is critical that the metrics used are aligned with business objectives. For instance, if your main business goal is to increase up-sell and cross-sell through knowledge-enabled contextual offers, reduction in call-handle times will be a conflicting metric. Keep in mind that KM delivers positive ROI in areas such as:
   - Increase in first-time fixes and revenue through up-sell and cross-sell
   - Reduction in escalations, transfers, repeat calls, call-handle times, training time, unwarranted product returns, field visits, and staff wage premiums
2. **Build the right team.** Successful KM implementations start with the right team for knowledge capture and creation. Therefore, build a cross-functional team that can bring an all-inclusive approach to knowledge creation. A best-practice team typically includes the following:
   - ***Lead expert.*** Individual who decides how the knowledge base will be organized, which topics will be covered, the roles of various team members, and plans for maintenance and use.
   - ***Users.*** High-performance contact center agents who provide invaluable suggestions.
   - ***Knowledge authors.*** Individuals who are trained to use knowledge authoring tools.
   - ***Project manager.*** Person who keeps the project moving on the right track.
3. **Avoid the "Swiss cheese" syndrome.** Ambitious deployments almost always result in a knowledge base that is solid in certain aspects, but full of holes (like a slice of Swiss

cheese) in many other places. This is a recipe for failure, because if users cannot find the answers, or get inadequate or wrong answers, they will quickly stop using the system. Therefore, one should focus on depth and quality rather than breadth. For instance, if an enterprise sells printers, scanners, and copiers, the best approach would be to cover one product line thoroughly first, then move on to the others.

4. **Maintain velocity.** A classic mistake in KM implementations is not making midcourse adjustments to keep the project on track. Best practices suggest that if the deployment appears to be falling behind schedule, it is better to narrow the scope of the knowledge base and finish it on schedule. In fact, it is better to widen the scope later to expand the benefits of the deployment. As a rough guide, a typical enterprise deployment should not take more than 3 months after the initial planning, with three or four full-time people engaged. Deployment includes software installation, knowledge gathering, and testing both the quality of the knowledge base and system performance.
5. **Balance "ivory tower knowledge" with "street smarts."** Enterprises often make the mistake of relying solely on internally focused domain experts who rarely speak to customers. It is sometimes difficult for experts to get down to the level of ordinary customers who may not know technical terms, such as whether their mutual fund is "no load," "frontloaded," or "back-loaded." Using jargon in questions posed by agents or self-service systems is a guaranteed way to increase escalations and customer attrition. A best practices–based solution would be to find contributors who are both technically competent and not too far from customer contact. Successful customer service depends as much on the questions posed to customers as the answers.
6. **Provide flexible content access.** People have different ways of finding information or the same person may use different methods based on the situation. A flexible approach to information access dramatically improves user adoption and ROI. For instance, novice agents, whether they are in-house or outsourced, may find it difficult to wade through hundreds of search hits to find the right answer, but they may fare better if they are guided through a dialog, powered by an inference engine. In contrast, experienced agents may prefer to quickly process search hits. It is better to provide users with multiple ways to access information, including FAQ, browse, search, and guided help. The key here is to make sure that the knowledge base remains completely integrated and that there are no content silos.

Source: A. Roy, "Knowledge Management for 'Stand-Out' Customer Service: Six Best Practices from the Global 2000," in "Best Practices in KM for Customer Service," a supplement to *KMWorld,* April 2009, No. 8–9.

Knowledge Management Valuation

In general, companies take either an asset-based approach to knowledge management valuation or an approach that links knowledge to its applications and business benefits (see Skyrme and Amidon, 1998). The former approach starts by identifying intellectual assets and then focuses management's attention on increasing their value. The second uses variants of a balanced scorecard, where financial measures are balanced against customer, process, and innovation measures. Among the best-developed measurement methods in use are the balanced scorecard approach (see Kestelyn, 2002; and Zimmermann, 2003a), Skandia's Navigator, Stern Stewart's economic value added (EVA), M'Pherson's inclusive valuation methodology, the return on management ratio, and Levin's knowledge-capital measure. Lunt (2001) described how Duke Children's Hospital, Hilton, and Borden improved performance across their enterprises through the balanced scorecard approach, leading to better customer service. See Skyrme and Amidon (1998) for details on how these measures work in practice.

Another method of measuring the value of knowledge is to estimate its price if it were offered for sale. Most firms are reluctant to sell knowledge unless they are expressly in the business of doing so. Generally, a firm's knowledge is an asset that has competitive value, and if it leaves the organization, the firm loses its competitive advantage. However,

the knowledge and access to the knowledge can be priced at a value, making it worth a firm's while to sell. For example, American Airlines' Decision Technologies Corp. grew from a small internal analysis team in the 1970s. Initially, the team was created to solve problems and provide decision support only to American Airlines. As it grew, it became an independent corporation within AMR Corp., and it began to provide consulting systems to other airlines, including American's competitors. The major consulting firms are in the business of selling expertise. Therefore, their knowledge management efforts, which began as internal systems, evolved into quite valuable systems that their clients use on a regular basis. Clearly, the same knowledge can be sold repeatedly.

Success indicators with respect to knowledge management are similar to those for assessing the effectiveness of other business-change projects. They include growth in the resources attached to the project, growth in the volume of knowledge content and usage, the likelihood that the project will survive without the support of a particular individual or individuals, and some evidence of financial return either for the knowledge management activity itself or for the entire organization.

FINANCIAL METRICS FOR KNOWLEDGE MANAGEMENT VALUATION Even though traditional accounting measures are incomplete for measuring knowledge management, they are often used as a quick justification for a knowledge management initiative. ROI is reported to range from 20:1 for chemical firms to 4:1 for transportation firms, with an average of 12:1, based on the knowledge management projects with which one consulting firm has been involved (see Abramson, 1998).

In order to measure the impact of knowledge management, experts recommend focusing knowledge management projects on specific business problems that can be easily quantified. When the problems are solved, the value and benefits of the system become apparent (see MacSweeney, 2002).

At Royal Dutch/Shell, the ROI was explicitly documented: The company invested $6 million in a KMS in 1999, and within 2 years it obtained $235 million in reduced costs and new revenues (see King, 2001). HP offers another example of documented financial returns. Within 6 months of launching its @HP company-wide portal in October 2000, HP realized a $50 million return on its initial investment of $20 million. This was largely due to a reduction in volume of calls to internal call centers and to the new paperless processes (see Roberts-Witt, 2002).

The financial benefit might be perceptual, rather than absolute, but it need not be documented in order for a KMS to be considered a success.

NONFINANCIAL METRICS FOR KNOWLEDGE MANAGEMENT VALUATION Traditional methods of financial measurement may fall short when measuring the value of a KMS, because they do not consider intellectual capital an asset. Therefore, it is necessary to develop procedures for valuing the intangible assets of an organization as well as to incorporate models of intellectual capital that in some way quantify innovation and the development and implementation of core competencies.

When evaluating intangibles, there are a number of new ways to view capital. In the past, only customer goodwill was valued as an asset. Now the following are included as well:

- ***External relationship capital.*** This is a measure of how an organization links with its partners, suppliers, customers, and regulators.
- ***Structural capital.*** This type of capital is based on systems and work processes that leverage competitiveness, such as information systems.
- ***Human capital.*** People have individual capabilities, knowledge, skills, and so on.
- ***Social capital.*** This is the quality and value of relationships with the larger society.
- ***Environmental capital.*** This is the value of relationships with the environment.

For example, a knowledge management initiative that Partners HealthCare System, Inc., undertook has not resulted in quantifiable financial benefits, but it has greatly increased the company's social capital. The KMS that Partners implemented for physicians reduced the number of serious medication errors by 55 percent at some of Boston's most prestigious teaching hospitals. Calculating ROI for such a system is an extremely difficult proposition, which is why only a small fraction of hospitals use similar systems. Although Partners is unable to determine how the system affects its bottom line, it is willing to justify the costs based on the system's benefits to society (see Melymuka, 2002). For more on knowledge management valuation, see Kankanhalli and Tan (2005), Chen (2005), Conway (2003), Hanley and Malafsky (2003), Smith and McKeen (2003), Stone and Warsone (2003), and Zimmermann (2003a).

Knowledge Management Failures

No system is infallible. There are many cases of KMS failing. Estimates of knowledge management failure rates range from 50 to 70 percent, where a failure is interpreted to mean that all the major objectives were not met by the effort (Ambrosio, 2000). Failures typically happen when the knowledge management effort mainly relies on technology and does not address whether the proposed system will meet the needs and objectives of the organization and its individuals (see Swan et al., 2000; Barth, 2000b; Berkman, 2001; Malhotra, 2003; McDermott, 2002; Roberts-Witt, 2000; and Sviokla, 2001). Other issues include lack of commitment (this occurred at a large Washington, D.C., constituent lobbying organization) and the failure to provide reasonable incentive for people to use the system (as occurred at Pillsbury Co.; see Barth, 2000b). The disasters of September 11, 2001, might have been avoided or lessened; therefore, in the United States, the Department of Homeland Security is making a massive effort to integrate its sources of knowledge (see Matthews, 2002). Soo et al. (2002) pointed out several knowledge traps that can lead to failure. We describe these in Technology Insights 11.5. Barth (2000b) described several important knowledge management initiatives that failed miserably. Finally, Roberts-Witt (2002) outlined how enterprises implementing portals can and do fail.

Knowledge management projects are among the most risky organizational endeavors. Success requires not only cutting-edge enablers of information technology, but also proper culture of knowledge sharing. While success of these projects brings positive improvements, their failures may also be devastating (see Application Case 11.9 for a representative example).

TECHNOLOGY INSIGHTS 11.5 KM Myths

Sometimes the intimate understanding of a complex concept (e.g., knowledge management) requires not only knowing what the concept is but also what it is not. Following are some myths associated with KM:

- ***Knowledge management is a fad.*** There are pessimists who think that KM is a new fashionable term prone to disappear soon. In fact, in today's business environment knowledge management is one of the most important tools for success. Knowing what you know and what you need to know cannot be a fad.
- ***Knowledge management is a new concept.*** Most people argue that knowledge management as a concept has been around for as long as human history. What is new is the way in which it is being managed using serious, systematic, and orderly means.
- ***Knowledge management is mere technology.*** Knowledge management is about people, relationships, and working together as a synergized entity. Technology is just an enabler to store and disseminate the knowledge assets. If the behavioral means that make people share knowledge are not present, there really is not anything to store and

disseminate. The vast majority of KM efforts have failed because they have been treated as IT projects, ignoring the most important part—the human aspects.

- ***Knowledge management and data warehousing are essentially the same.*** Data warehousing implies a repository of data, not knowledge. Even though data warehousing is essential for KM (as an enabling technology), it falls short on representing the behavioral characteristics of KM.
- ***Knowledge management is another form of reengineering.*** Reengineering is a one-time attempt at introducing radical change to organizational processes to improve efficiency. KM, in contrast, is an ongoing effort of enhancing organizational processes to better identify, store, and disseminate knowledge to whomever and whenever it is needed to improve an organization's competitive posture.
- ***Knowledge management is a part of data management.*** The idea behind this myth is that because data is being collected throughout the organization, it should also be converted into information and knowledge so that when it is needed it can be readily available. This, supply-driven approach to KM is shortsighted because knowledge is context sensitive and volatile. Instead, demand-driven KM, where the needed knowledge determines the nature of the knowledge acquisition and dissemination process, produces significant benefits.
- ***It is a "no-brainer" to share what you know.*** People do not want to share what they know, because they are what they know. In general, only secure people who are assured of the potential benefits of sharing willingly share their knowledge. Sharing has a lot to do with a corporate culture where sharing is not only respected and encouraged, but also properly rewarded.

Source: E. Awad and H. M. Ghaziri, *Knowledge Management,* Prentice Hall, Upper Saddle River, NJ, 2004.

APPLICATION CASE 11.9

When KMS Fail, They Can Fail in a Big Way

Accenture was a pioneer in organization-wide knowledge management efforts. Even though Accenture devoted significant resources to its global KMS, it simply failed at being effective in capturing and disseminating knowledge throughout the organization. Since the early 1990s, Accenture has spent over $500 million on IT and employees to support its global knowledge management strategy. And it continues to support it. In a study of its efforts, researchers discovered that it just was not working as well as it could have. One major problem was cultural. Accenture did not take into consideration local or regional challenges at a reasonable level. For example, the firm was totally unsuccessful in getting its East Asian consultants to contribute to the system because managers never demonstrated appreciation for these efforts. Accenture also apparently did not handle cross-cultural challenges well. Finally, because this was a global effort, the needs of local offices were totally subsumed.

Some of this can be explained by a recent research study. In an examination of five well-documented knowledge management failures, it was discovered that knowledge management failure factors fall into four categories: technology, culture, content, and project management. Clearly, Accenture had culture-based problems.

Other famous knowledge management failures include those of Ford and Firestone. When the tires started blowing out on the Ford Explorer, it cost the company $1.25 billion. In this case, the knowledge was available; it was just not integrated in a way that allowed stakeholders to access and analyze it. International police agencies historically have not effectively shared knowledge; therefore, terrorist activities, such as those that led to the events of September 11, 2001, continue. Today, despite the fact that much can be learned from failures, it is difficult to extract information about them from most organizations.

Sources: Partly adapted from Y. Park and D. Y. Choi, "The Shortcomings of a Standardized Global Knowledge Management System: The Case Study of Accenture," *Academy of Management Executive,* Vol. 19, No. 2, May 2005, pp. 81–85; and S. Patton, "Putting the Pieces Together," *Darwin,* February 2002.

Factors That Lead to Knowledge Management Success

To increase the probability of success of knowledge management projects, companies must assess whether there is a strategic need for knowledge management in the first place. The next step is to determine whether the current process of dealing with organizational knowledge is adequate and whether the organization's culture is ready for procedural changes. Only when these issues are resolved should the company consider technology infrastructure and decide whether a new system is needed. When the right technological solution is chosen, it becomes necessary to properly introduce it to the entire organization and to gain the participation of every employee (see Kaplan, 2002). It is important not to rely too heavily on technology to succeed (Jacob and Ebrahimpur, 2001). Typically, a knowledge management effort is only about 10 to 20 percent technology. The rest of the effort is organizational. While implementing knowledge management projects, one should try to avoid the common traps, some of which are described in Technology Insights 11.6.

TECHNOLOGY INSIGHTS 11.6 Knowledge Management Traps

A recent study of the knowledge management practices of six firms identified several knowledge traps into which even the best firms fell. These can help show the way to avoid failure in knowledge management efforts. The following lessons were learned:

- ***Formal databases must be treated as strategic tools rather than mere storage facilities.*** Sometimes database systems are perceived as too complicated to use, so they are underused. Strategic information is overlooked because it is too difficult to get to. The organization must make it possible to get to the information and to really capture and codify knowledge.
- ***Managing formal database systems per se does not equate to knowledge management.*** Databases are important for capturing information, but a strong, informal network is necessary for good access. Also, databases are only one component of a KMS. When textual data are stored, we really consider this a knowledge repository, not a database.
- ***Informal networking is an important source of knowledge, but overreliance on it can be detrimental.*** Even though informal channels often contain critical information, there is an inherent risk that informal interactions may be too dependent on chance. Lack of structure can lead to knowledge loss.
- ***Structure is important.*** To reduce the susceptibility of informal networking to randomness, it should be made more structured.
- ***Senior management may not know the true state of their firm's KMS.*** There is a distinct difference between the perceptions of senior managers and junior managers in their views of the effectiveness of their KMS. This is mainly because the senior managers do not actively use the system, while junior managers do. The attitudes of senior managers may not be the best measure of the success of a KMS.
- ***You can't teach an old dog new tricks.*** Generally, older managers do not absorb new training well.
- ***Unless carefully managed, knowledge is a dark power.*** It is difficult to determine how to generate knowledge that is truly useful for an organization. Organizational factors may hinder the capture and free distribution of knowledge. Trust is critical.
- ***Creativity in problem solving is the main driver of new knowledge creation and innovation.*** However, creativity must be supported by appropriate mechanisms. Resources must be provided to help employees be creative. Often, lack of time hinders individuals. They may be expected to contribute and use knowledge in a KMS, while not diminishing any other aspect of their jobs.

Sources: C. Soo, T. Devinney, D. Midgley, and A. Dering, "Knowledge Management: Philosophy, Processes, and Pitfalls," *California Management Review,* Summer 2002, Vol. 44, No. 4, pp. 129–150; and Y. Malhotra, "Why Knowledge Management Systems Fail?" 2004, **brint.org/WhyKMSFail.htm** (accessed June 2009).

Major factors that lead to knowledge management project success (adapted from Davenport et al., 1998) include the following:

- A link to a firm's economic value, to demonstrate financial viability and maintain executive sponsorship.
- A technical and organizational infrastructure on which to build.
- A standard, flexible knowledge structure to match the way the organization performs work and uses knowledge. Usually, the organizational culture must change to effectively create a knowledge-sharing environment.
- A knowledge-friendly culture that leads directly to user support.
- A clear purpose and language, to encourage users to buy into the system. Sometimes simple, useful knowledge applications need to be implemented first.
- A change in motivational practices, to create a culture of sharing.
- Multiple channels for knowledge transfer, because individuals have different ways of working and expressing themselves. The multiple channels should reinforce one another. Knowledge transfer should be easily accomplished and as unobtrusive as possible.
- A level of process orientation to make a knowledge management effort worthwhile. In other words, new, improved work methods can be developed.
- Nontrivial motivational methods, such as rewards and recognition, to encourage users to contribute and use knowledge.
- Senior management support is critical to initiate a project, provide resources, help identify important knowledge on which the success of the organization relies, and market the project.

Effective knowledge sharing and learning require cultural change within the organization, new managerial practices, senior management commitment, and technological support. The organizational culture must shift to a culture of sharing. This should be handled through strong leadership at the top and by providing knowledge management tools that truly make people's jobs better. As far as encouraging system use and knowledge sharing goes, people must be properly motivated to contribute knowledge. The mechanism for doing so should be part of their jobs, and their salaries should reflect this. People must also be motivated to use the knowledge in the KMS. Again, this should be part of their jobs and their reward structures.

As more companies develop knowledge management capabilities, some of the ground rules are becoming apparent. Success depends on a clear strategic logic for knowledge sharing, the choice of appropriate infrastructure (technical or nontechnical), and an implementation approach that addresses the typical barriers: motivation to share knowledge, resources to capture and synthesize organizational learning, and ability to navigate the knowledge network to find the right people and data.

Potential Drawbacks of KMS

Although managing knowledge has many positive outcomes, as discussed in examples throughout this chapter, it would be shortsighted to not consider the potential negative outcomes associated with reusing knowledge. Henfridsson and Söderholm (2000) analyzed the situation that Mrs. Fields Gifts faced. Mrs. Fields grew remarkably fast and successfully during the early 1980s. A key aspect of the company's strategy was to provide expertise directly from the headquarters to every store. As the number of stores increased, the only feasible way to achieve direct control was through the use of information systems designed to mimic the decision making of the real Debbi Fields. Systems placed in each store would input data (e.g., temperature, day of the week, date); the system would process them and output instructions telling the store manager, say, how many cookies of each type to bake each hour. In essence, the software provided each store manager with explicit directions for planning each day's production, sales, and labor scheduling, along with inventory control

and ordering. Because of the well-functioning computer systems, which in principle were systems designed to make the company's tacit knowledge available to all stores, Mrs. Fields was able to successfully function with few managerial levels. However, Mrs. Fields was very slow to respond as the market began to change and consumers became more health conscious. By embedding so much knowledge into systems that were incapable of adaptation, the organization tied itself to a certain way of doing things and failed to engage in knowledge creation (i.e., failed to pick up the signals in the environment that might have suggested a change in strategy or product focus). By the early 1990s, the company had fallen into bankruptcy. The situation at Mrs. Fields illustrates that while organizations may achieve significant short-term gains through KMS, they must not neglect the creative process of new knowledge creation, lest they find themselves applying yesterday's solutions to tomorrow's problems.

Closing Remarks on Knowledge Management

For millennia, we have known about the effective use of knowledge and how to store and reuse it. Intelligent organizations recognize that knowledge is an intellectual asset, perhaps the only one that grows over time, and, when harnessed effectively, can sustain competition and innovation. Organizations can use IT to perform true knowledge management. Leveraging an entire organization's intellectual resources can have tremendous financial impact.

With knowledge management, the definition is clear, the concepts are clear, the methodology is clear, the challenges are clear and surmountable, the benefits are clear and can be substantial, and the tools and technology—though incomplete and somewhat expensive—are viable. Key issues are organizational culture, executive sponsorship, and measurement of success. Technological issues are minimal compared to these. Knowledge management is not just another expensive management fad. Knowledge management is a new paradigm for how we work.

Section 11.9 Review Questions

1. Describe the need for measuring the success of KMS.
2. What are the issues in knowledge management valuation?
3. List some financial (tangible) metrics of knowledge management.
4. List some intangible (nonfinancial) metrics of knowledge management.
5. List failure factors associated with knowledge management.
6. List success factors associated with knowledge management.
7. What are the potential drawbacks of KMS?
8. Describe expert location systems.

Chapter Highlights

- Knowledge is different from information and data. Knowledge is information that is contextual, relevant, and actionable.
- Knowledge is dynamic in nature. It is information in action.
- Tacit (i.e., unstructured, sticky) knowledge is usually in the domain of subjective, cognitive, and experiential learning; explicit (i.e., structured, leaky) knowledge deals with more objective, rational, and technical knowledge, and it is highly personal and difficult to formalize.
- A learning organization has an organizational memory and a means to save, represent, and share it.
- Organizational learning is the development of new knowledge and insights that have the potential to influence behavior.
- The ability of an organization to learn, develop memory, and share knowledge is dependent on its culture. Culture is a pattern of shared basic assumptions.
- Knowledge management is a process that helps organizations identify, select, organize, disseminate, and transfer important information and expertise that typically reside within the organization in an unstructured manner.
- The fastest, most effective and powerful way to manage knowledge assets is through the systematic transfer of best practices.

- Knowledge management requires a major transformation in organizational culture to create a desire to share (i.e., give and receive) knowledge and a commitment to knowledge management at all levels of the firm.
- The knowledge management model involves the following cyclical steps: create, capture, refine, store, manage, and disseminate knowledge.
- The CKO is primarily responsible for changing the behavior of the firm to embrace the use of knowledge management and then managing the development operation of a KMS.
- A COP provides pressure to break down the cultural barriers that hinder knowledge management efforts.
- Knowledge management is an effective way for an organization to leverage its intellectual assets.
- It is difficult to measure the success of a KMS. Traditional methods of financial measurement fall short because they do not consider intellectual capital an asset.
- Two knowledge management approaches are the process approach and the practice approach.
- The two strategies used for knowledge management initiatives are the personalization strategy and the codification strategy.
- The two storage models used for knowledge management projects are the repository storage model and the network storage model.
- Standard knowledge management initiatives involve the creation of knowledge bases, active process management, knowledge centers, collaborative technologies, and knowledge webs.
- A KMS is generally developed using three sets of technologies: communication, collaboration, and storage.
- A variety of technologies can make up a KMS, including the Internet, intranets, data warehousing, decision support tools, and groupware. Intranets are the primary vehicles for displaying and distributing knowledge in organizations.
- Knowledge management is not just another expensive management fad. It is a new paradigm for the way we work.

Key Terms

best practices *491*
chief knowledge officer (CKO) *504*
community of practice (COP) *506*
content management system (CMS) *500*
electronic document management (EDM) *499*
enterprise knowledge portal (EKP) *499*
expert location system *512*
explicit knowledge *478*
intellectual capital *474*
knowledge *475*
knowledge-based economy *476*
knowledge discovery in databases (KDD) *496*
knowledge management (KM) *474*
knowledge management system (KMS) *480*
knowledge repository *488*
knowware *498*
leaky knowledge *478*
learning organization *481*
model mart *497*
model warehouse *497*
organizational culture *482*
organizational learning *482*
organizational memory *482*
practice approach *488*
process approach *486*
tacit knowledge *478*

Questions for Discussion

1. Why is the term *knowledge* so difficult to define?
2. Describe and relate the different characteristics of knowledge to one another.
3. Explain why it is important to capture and manage knowledge.
4. Compare and contrast tacit knowledge and explicit knowledge.
5. Explain why organizational culture must sometimes change before knowledge management is introduced.
6. How does knowledge management attain its primary objective?
7. How can employees be motivated to contribute to and use KMS?
8. What is the role of a knowledge repository in knowledge management?
9. Explain the importance of communication and collaboration technologies to the processes of knowledge management.
10. Explain why firms adopt knowledge management initiatives.
11. Explain how the wrong organizational culture can reduce the effectiveness of knowledge management.
12. Explain the role of the CKO in developing a KMS. What major responsibilities does he or she have?
13. What is meant by a culture of knowledge sharing?
14. Discuss the factors related to knowledge management success.
15. Why is it so difficult to evaluate the impacts of knowledge management?
16. Explain how the Internet and related technologies (e.g., Web browsers, intranets) enable knowledge management.
17. List the three top technologies most frequently used for implementing KMS and explain their importance.
18. Explain the role of a community of practice.
19. Describe an EKP and explain its significance.

Exercises

TERADATA STUDENT NETWORK (TSN) AND OTHER HANDS-ON EXERCISES

1. Make a list of all the knowledge management methods you use during your day (work and personal). Which are the most effective? Which are the least effective? What kinds of work or activities does each knowledge management method enable?
2. Investigate the literature for information on the position of CKO. Find out what percentage of firms with knowledge management initiatives have CKOs and identify their responsibilities.
3. Investigate the literature for new measures of success (metrics) for knowledge management and intellectual capital. Write a report based on your findings.
4. Describe how each of the key elements of a knowledge management infrastructure can contribute to its success.
5. Based on your own experience or on the vendor's information, list the major capabilities of a particular knowledge management product and explain how it can be used in practice.
6. Describe how to ride a bicycle, drive a car, or make a peanut butter and jelly sandwich. Now have someone else try to do it based solely on your explanation. How can you best convert this knowledge from tacit to explicit (or can't you)?
7. Examine the top five reasons that firms initiate KMS and investigate why they are important in a modern enterprise.
8. Read the article by E. Berkman titled "Don't Lose Your Mind Share," available at **cio.com/archive/100100/mindshare.html**. Describe the major problems that Hill and Knowlton faced in February 1999 and what Ted Graham did to solve them.
9. Read *How the Irish Saved Civilization* by Thomas Cahill (New York: Anchor, 1996) and describe how Ireland became a knowledge repository for Western Europe just before the fall of the Roman Empire. Explain in detail why this was important for Western civilization and history.
10. Examine your university, college, or company and describe the roles that the faculty, administration, support staff, and students have in the creation, storage, and dissemination of knowledge. Explain how the process works. Explain how technology is currently used and how it could potentially be used.

TEAM ASSIGNMENTS AND ROLE-PLAYING

1. Compare and contrast the capabilities and features of electronic document management with those of collaborative computing and of KMS. Each team should represent one type of system.
2. Search the Internet for knowledge management products and systems and create categories for them. Assign one vendor to each team. Describe the categories you created and justify them.
3. Consider a decision-making project in industry for this course or from another class or from work. Examine some typical decisions in the project. How would you extract the knowledge you need? Can you use that knowledge in practice? Why or why not?
4. Read the article by A. Genusa titled "Rx for Learning," available at **cio.com/archive/020101/tufts.html**, which describes Tufts University Medical School's experience with knowledge management. Determine how these concepts and such a system could be implemented and used at your college or university. Explain how each aspect would work, or if it would not work, explain why it would not.

INTERNET EXERCISES

1. How does knowledge management support decision making? Identify products or systems on the Web that help organizations accomplish knowledge management. Start with **brint.com** and **knowledgemanagement.com**. Try one out and report your findings to the class.
2. Try the KPMG Knowledge Management Framework Assessment Exercise at **kmsurvey.londonweb.net** and assess how well your university (or company) is doing with knowledge management. Are the results accurate? Why or why not?
3. Search the Internet to identify sites that deal with knowledge management. Start with **google.com**, **kmworld.com**, **kmmag.com**, and **km-forum.org**. How many did you find? Categorize the sites based on whether they are academic, consulting firms, vendors, and so on. Sample one of each and describe the main focus of the site.
4. Identify five real-world knowledge management success stories by searching vendor Web sites (use at least three different vendors). Describe them. How did KMS methods contribute to their success? What features do they share? What different features do individual successes have?
5. Search the Internet for vendors of knowledge management suites, EKP, and out-of-the-box knowledge management solutions. Identify the major features of each product (use three from each) and compare and contrast their capabilities.
6. Access the Microsoft Web site and investigate the current capabilities of its knowledge management initiative.

END OF CHAPTER APPLICATION CASE

Siemens Keeps Knowledge Management Blooming with ShareNet

Siemens AG, a $73 billion electronics and electrical engineering conglomerate, produces everything from light bulbs to x-ray machines, power-generation equipment, and high-speed trains. During its 156-year history, Siemens has become one of the world's largest and most successful corporations. Siemens is well known for the technical brilliance of its engineers, but much of their knowledge used to be unavailable to other employees. Facing pressures to maximize the benefits of corporate membership of each business unit, Siemens AG needed to learn how to leverage the knowledge and expertise of its 460,000 employees worldwide.

Solution

The roots of knowledge management at Siemens go back to 1996, when a number of people in the corporation who had an interest in knowledge management (KM) formed a community of interest. They researched the subject, learned what was being done by other companies, and determined how KM could benefit Siemens. Without suggestion or encouragement from senior executives, midlevel employees in Siemens business units began creating repositories, communities of practice, and informal knowledge-sharing techniques. By 1999, Siemens AG's central board confirmed the importance of KM to the entire company by creating an organizational unit that would be responsible for the worldwide deployment of knowledge management.

Siemens's movement toward KM has presented several challenges to the company, the most notable of which are technological and cultural. At the heart of Siemens's technical solution to knowledge management is a Web site called ShareNet, which combines elements of a database repository, a chat room, and a search engine. Online entry forms allow employees to store information they think might be useful to colleagues. Other Siemens employees are able to search the repository or browse by topic and then contact the authors for more information, using one of the available communication channels. In addition, the system lets employees post alerts when they have an urgent question. Although knowledge management implementation at Siemens involved establishing a network to collect, categorize, and share information using databases and intranets, Siemens realized that IT was only the tool that enabled knowledge management. Randall Sellers, director of knowledge management for the Americas Region of Siemens, stated, "In my opinion, the technology or IT role is a small one. I think it's 20 percent IT and 80 percent change management—dealing with cultural change and human interfaces."

Siemens has used a three-pronged effort to convince employees that it is important to participate in the exchange of ideas and experiences and to share what they know. The challenge is managing the people who manage the knowledge. It has to be easy for them to share, or they won't. Siemens has assigned 100 internal evangelists around the world to be responsible for training, answering questions, and monitoring the system. Siemens's top management has shown its full support for the KM projects, and the company is providing incentives to overcome employees' resistance to change. When employees post documents to the system or use the knowledge, Siemens rewards them with "shares" (similar to frequent-flyer miles). An employee's accumulation of shares can be exchanged for things such as consumer electronics or discounted trips to other countries. However, the real incentive of the system is much more basic. Commission-driven salespeople have already learned that the knowledge and expertise of their colleagues available through ShareNet can be indispensable in winning lucrative contracts. Employees in marketing, service, research and development, and other departments are also willing to participate and contribute when they realize that the system provides them with useful information in a convenient way.

ShareNet has undergone tremendous growth, which has resulted in several challenges for Siemens. The company strives to maintain a balance between global and local knowledge initiatives as well as between KM efforts that support the entire company and those that help individual business units. Furthermore, Siemens works to prevent ShareNet from becoming so overloaded with

knowledge that it becomes useless. A group is assigned to monitor the system and remove trivial and irrelevant content.

Results

ShareNet has evolved into a state-of-the-art Web-based knowledge management system (KMS) that stores and catalogs volumes of valuable knowledge, makes it available to every employee, and enhances global collaboration. Numerous companies, including Intel, Philips Electronics, and Volkswagen, studied ShareNet before setting up their own KMS. Teleos, an independent knowledge management research company, has acknowledged Siemens as one of the most admired knowledge enterprises worldwide for 5 years in a row.

Siemens has realized a variety of quantifiable benefits afforded by knowledge management. For example, in April 1999, the company developed a portion of ShareNet to support the Information & Communications Networks Group, at a cost of $7.8 million. Within 2 years, the tool helped to generate $122 million in additional sales.

Ultimately, knowledge management may be one of the major tools that will help Siemens prove that large, diversified conglomerates can work and that being big might even be an advantage in the information age.

Questions for the Case

1. How did the Siemens KMS evolve?
2. How does Siemens view knowledge (i.e., intellectual) assets?
3. What does "leveraging expertise" mean? How did Siemens do this? Explain how this relates to Siemens's high return on investment.
4. Describe the benefits of the Siemens ShareNet KMS.
5. Explain the culture transformation as it occurred at Siemens. Include in your answer how the various constituencies bought into the system.
6. Explain how Internet and Web technologies enabled the Siemens KMS.

Sources: Adapted from G. S. Vasilash, "447,000 Heads Are Better Than One," *Automotive Design & Production,* June 2002; "Business: Electronic Glue," *The Economist,* June 2, 2001; S. Williams, "The Intranet Content Management Strategy Conference," *Management Services,* September 2001; M. Santosus, "How Siemens Keeps KM Blooming," *In the Know at CIO.com,* February 2003, **cio.com/research/knowledge/edit/k021003_bloom.html**.

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