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Knowledge management is about using the brain power of an organization in a systematic and organized manner in order to achieve efficiencies, ensure competitive advantage, and spur innovation. This chapter discusses the fundamentals of knowledge management, its definitions, components, processes, and relevance for higher education, in general, and institutional research, in particular.

Overview of Knowledge Management

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In the early 1990s, corporations coined the concept and movement of knowledge management, which is an institutional systematic effort to capitalize on the cumulative knowledge that an organization has. "Knowledge management is a fast-moving field created by the collision of several others, including human resources, organizational development, change management, information technology, brand and reputation management, performance measurement, and evaluation" (Bukowitz and Williams, 1999).

Although a fairly young field, knowledge management has gained tremendous popularity very quickly in the business world. Journals dedicated to this topic include *Knowledge Management Magazine, Knowledge Management Review,* and *Knowledge Management World Magazine.* There are conferences either exclusively dedicated to this field, such as KM World or the Knowledge Management Conferences organized by the American Productivity and Quality Center, or prominently featuring knowledge management both in terms of presentations and vendors, such the annual conferences held by Gartner Research Group and EDUCAUSE. Consulting groups—both well established with a large client base and small, regionally based—have rushed to advertise knowledge management as one of their areas of expertise. Prominent examples include the Gartner Group, the American Productivity and Quality Center, and Klynveld, Peat, Marwick, Goerdeler (KPMG).

Knowledge management presents a significant business opportunity. According to industry expert Ovum (cited in VNU Business Media, 2001), the worldwide knowledge management market will be worth $12.3 billion by the year 2004. More specifically, Ovum forecasts that the worldwide market for knowledge management–related software will increase from $515 million in 1999 to $3.5 billion by 2004. Knowledge management–related services are expected to grow from $2.6 billion in 1999 to $8.8 billion by

2004. Among the knowledge management services are those provided by training and performance improvement organizations. Are these impressive figures paralleled by results? A 2001 survey by Reuters finds that 90 percent of companies that deploy a knowledge management solution benefit from better decision making and 81 percent say that they notice increased productivity (Malhotra, 2001). Several reasons account for and technological developments have led to the emergence and growth of this field.

Reasons for Emergence and Growth of Knowledge Management

Reasons for the emergence and growth of this field include the following.

Information Overload and Chaos. Information overwhelms corporations, schools, classrooms, and our minds. Finding what we need to complete a task, especially more complex ones, can be time consuming and frustrating if we do not have access to a well-organized, readily available infrastructure that contains the type of information needed. Information resides in many different sources, some easily accessible, others volatile and highly personal. As Microsoft founder Bill Gates noted in his presentation at COMDEX Fall 1999: "Corporate information today is so hard to find. It's kept in folders, or anecdotally understood by people in the company" (cited in VNU Business Media, 2001). Gates added, "Knowledge workers need to share things, and need access to the right information at the right time. This is so hard today." What is true? Which solution is better? Or what are the solutions? What we have gained are volumes of unfiltered and unprocessed information and what we struggle to find are the time and the ability to respond quickly to ever increasing demands and expectations from our employers and clients, whether they are students or faculty or staff.

Information Congestion. Communication channels bottleneck in our computer networks. We sometimes hear that the Internet access is slow during peak hours at work because too many of us are searching the Web at the same time. Sometimes the speed with which we can tap into available internal data warehouses or transactional operational systems is less than desirable because too many of us are accessing vast amounts of data, thus putting a significant strain on our systems. If we had the mechanisms to target very specifically the data or information we are looking for, the overall speed of our networks would be consistently at its best capacity.

Information and Skill Segmentation and Specialization. The Renaissance era, when a single individual mastered many different domains, is long gone. While there are always exceptions to confirm the rule, most individuals can now master only one domain of expertise and sometimes only segments within one domain. It is often the case that the completion of various projects requires access to and corroboration of information from multiple domains. Having access to the right information, at the right time,

without necessarily being an expert in all domains involved, would greatly improve individual and organizational efficiency and effectiveness.

Workforce Mobility and Turnover. The average years an employee spends on one career have been shortened from lifelong to ten and now to three years (United States Department of Labor, 2000). When colleagues retire or change jobs, they take with them valuable experiences and skills for which the institution has paid a premium to search and train. A 2001 survey found that while "26 percent of knowledge in the average organization is stored on paper and 20 percent digitally, an astonishing 42 percent is stored in employees' heads" (Malhotra, 2001). Organizations are increasingly recognizing that capturing and sharing these experiences and skills save them money, prevent or reduce interruptions in activities, and enhance their overall ability to cope with changes in personnel.

Competition. This has always been a main driver for improvement and innovation in the business environment. With the propagation of nontraditional higher education providers and modalities of instructional delivery, such as University of Phoenix and online courses and programs, colleges and universities are increasingly finding themselves competing for students much more than they were accustomed to a decade ago. Being able to anticipate changes in our environments and demands for new programs or courses, and to respond quickly, are becoming prerequisites for how higher education must operate in order to survive, thrive, and adapt to change.

Technological Developments Contributing to Emergence and Growth of Knowledge Management

Whereas knowledge management is not defined by technology, technologies support knowledge management (Hildebrand, 1999; Hayward, 2000). Without the advent of powerful and sophisticated hardware and software tools, the field of knowledge management would have been at most a good subject for theoretical lectures and philosophical exercises. Knowledge management processes perform best when enabled by powerful, yet fairly easy to use once implemented, technologies. As discussed throughout this volume, emphasis on technology alone will achieve little progress toward knowledge management, but even the strongest commitment to knowledge management that is not supported by robust technology will not succeed.

The intersection of the above-mentioned reasons and the fast technological developments of the 1990s has produced an environment conducive to translating the theoretical foundation of knowledge management into practice. Whereas the fact that knowledge is power is as old as the human civilization, having the means to put in place organizationwide systems that constantly and systematically capture and capitalize on this power is a fairly recent, evolving capability.

In finding ways to work with knowledge as an asset, organizations are transforming knowledge from an abstract concept to an increasingly tangible and manageable one. This transformation has spawned new concepts and terminology, thereby strengthening the relationship between information and technology, as well as developing new processes and approaches to designing information resources and new cultures (VNU Business Media, 2001). The remainder of this chapter is dedicated to describing these concepts, terminology, processes, and cultures and their applicability to higher education in general and institutional research in particular.

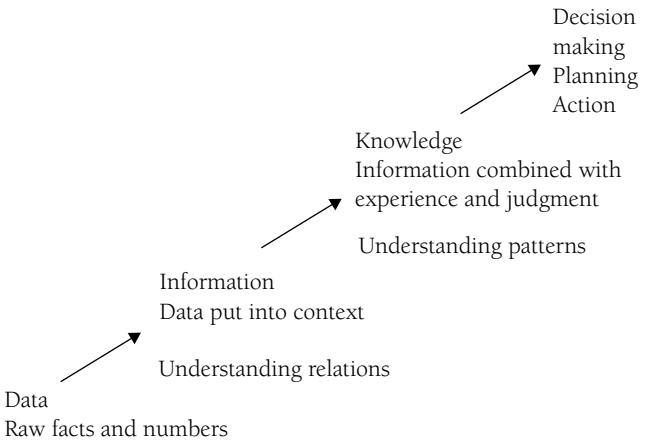
What Is Knowledge?

Epistemology is the study of the nature and grounds of knowledge. Epistemologists reason that knowledge is "justified belief." They contemplate the eternal challenge of separating true from false. As Nonaka and Takeuchi (1995) point out: "we consider knowledge as a dynamic human process of justifying personal belief toward the 'truth.'" There has been a lineage of this branch of philosophy that recognized knowledge as awareness of absolute and permanent facts. Kantian synthesis, a branch of rationalism and empiricism, later developed the notion that knowledge came from the organization of perceptual data on the basis of categories, including space, time, objects, and causality. Their theory moved from Plato's view to the subjectivity of basic concepts about space and time. At the turn of the century, a subbranch called pragmatism, an American movement in philosophy founded by C. S. Peirce and William James, extended its definition of knowledge as a result of the influence of artificial intelligence and quantum mechanics. It stated that knowledge consists of "models," which reflect the surrounding environment, resulting in targeted, simplified problem-solving and cognitive conclusions. The evolution (not to be confused with evolutionary epistemology) of epistemology resembles the modern recognition of the knowledge creation hierarchy: data to information to knowledge as represented in Figure 1.1.

Plato's view of absolute and permanent attributes of knowledge is the equivalent of the starting point of knowledge: data. Data are building blocks that are unitary, independent, and timeless. Data are raw facts and numbers, which can be informative but by themselves provide little value for decision making, planning, or any other action. Data gain meaning once they are put into context (Kidwell, Vander Linde, and Johnson, 2000) and once the relations between data and context are understood. "[When] endowed with relevance and purpose," as Drucker (1999) stated, data become information. Davenport and Prusak (1998) listed the following values added by the transformation of data into information: contextualization, categorization, calculation, correction, and condensement.

Knowledge combines information with individual, group, and organizational experience and judgment, and it involves making a leap from

Figure 1.1. From Data to Knowledge



understanding relations to understanding patterns that can guide action. Or as O'Dell, Essaides, and Ostro (1998) describe, "knowledge is information in action." Davenport and Prusak (1998) point to the following processes involved in the transformation of information into knowledge: comparison, consequence, connection, and conversation.

Explicit Versus Tacit Knowledge

Knowledge takes various forms. Edvinson and Malone (1997), both organizational experts, categorize knowledge into individual, structural, and organizational. They regard structural knowledge as what has been codified into manuals and reports and organizational knowledge the activity of learning within the organization. Structural knowledge builds on data available in databases and data warehouses and on the other fluid, intangible, personalized entities that exist only in biological human brains. Modern philosopher and chemist Polanyi (1964, 1974, 1983) and practitioners Nonaka and Takeuchi (1995) have, at different times, reasoned that structured or codified building blocks are explicit knowledge whereas unstructured, difficult-to-codify building blocks are tacit knowledge. Crowley (2000) echoed that explicit knowledge, as codified knowledge, is transmittable in formal, systematic language; and tacit knowledge is personal, context-specific, and difficult to formalize and codify. Tacit knowledge is personal in origin, job specific, related to context, difficult to fully articulate, and poorly documented but highly operational in the minds of the possessor (Kidwell, Vander Linde, and Johnson, 2000). Table 1.1 summarizes the features and sources of explicit and tacit knowledge.

Knowledge management is, then, the systematic and organized approach of organizations to manipulate and take advantage of both explicit

Table 1.1. Explicit Versus Tacit Knowledge

	Explicit Knowledge (Documented)	*Tacit Knowledge (Know-how embedded in people)*
Features	Easily codified Storable Transferable Easily expressed and shared	Personal Context-specific Difficult to formalize Difficult to capture, communicate, share
Sources	Manuals Policies and procedures Databases and reports	Informal business processes and communications Personal experiences Historical understanding

and tacit knowledge, which in turn leads to the creation of new knowledge. Or as the American Productivity and Quality Center summarizes: "Knowledge Management is the systematic process of identifying, capturing, and transferring information and knowledge people can use to create, compete, and improve." These activities are not entirely discrete, but they cause a different focus on processes, tools, techniques, and the individuals or groups to whom they are addressed (Hayward, 2000). These aspects are discussed in the next section of the chapter and are further exemplified by the other chapters in the volume.

Sources of Knowledge

Davenport and Prusak (1998) suggest five types of knowledge that correspond to the source of each.

• *Acquired knowledge* comes from outside the organization. In some cases, an organization purchases the knowledge from another source. Similarly, information can be leased or rented. For example, some "rented" knowledge comes from consultants. Institutional research relies heavily on rented knowledge such as U.S. Census Data, Integrated Postsecondary Education Data System (IPEDS) files, research methods, to name a few. Davenport and Prusak note that "originality is less important than usefulness" in acquired knowledge.

• *Dedicated resources* are those in which an organization sets aside some staff members or an entire department (usually research and development) to develop within the institution for a specific purpose. These dedicated resources are usually protected from competitive pressures to develop profitable products. Offices of institutional research are by themselves good examples of dedicated resources to the extent that they generally serve specific purposes, which are not duplicated or shared by other departments and offices. This is particularly true when institutional research functions are centralized within one office.

• *Fusion* is knowledge created by bringing together people with different perspectives to work on the same project. The resulting projects represent more comprehensive expertise than possible if members of the team represented one perspective. But Davenport and Prusak note that fused knowledge often involves conflict, and a team needs time to reach a shared knowledge and language. Cross-functional teams are becoming popular in higher education institutions and are examples of fusion. Institutional researchers are often called upon to participate in various teams due to their expertise.

• *Adaptation* is knowledge that results from responding to new processes or technologies in the market place. The expansion of on-line instruction offered by higher education institutions is an example of adaptation.

• *Knowledge networking* is knowledge in which people share information with one another formally or informally. Knowledge networking often occurs within disciplines; for example, an institutional researcher communicating with another.

Knowledge Management: Taxonomy, Processes, and Components

Knowledge management involves a number of iterative processes, some of which are intertwined and could occur simultaneously. The premise of these processes is that knowledge management implies continuous and ongoing renewal of organizational schemas to anticipate future opportunities and threats (Malhotra, 1998). These processes "link people and knowledge content" (Hayward, 2000) and are summarized in Figure 1.2.

At the core of the knowledge management framework is the creation of knowledge. All organizations, higher education institutions, in particular, create knowledge. Creation of knowledge can occur through a variety

Figure 1.2. Knowledge Management Processes

Knowledge Content

Knowledge Management Processes				
Create • Discover • Realize • Conclude • Articulate • Discuss	**Capture** • Digitize • Document • Extract • Represent • Store	**Organize** • Structure • Catalog • Abstract • Analyze • Categorize	**Access** • Present • Display • Notify • Profile • Find	**Use** • Make • Improve • Perform • Service • Learn
Collaborate	Find	Mediate	Facilitate	Augment	Share	Align

People Processes

Source: Gartner Research, in Hayward (2000). Reproduced with permission of Gartner Group.

of means, such as scientific discovery or discussions. However, knowledge can be easily lost or not used if it is not captured. From a technological perspective, capturing knowledge can be achieved through digitization, documentation, extraction, representation, and storage. There are numerous techniques and software tools available for each of these methods, and they are addressed in Chapter Six.

Far more important in the process of knowledge management is knowledge sharing. The tacit knowledge possessed by individuals is crucial and instrumental to an organization's operation and survival. However, reaching the point where employees willingly share what they know "is one of the toughest nuts organizations have to crack" (Bukowitz and Williams, 1999). Technology has made it relatively easy to organize, post, and transfer certain types of information. "On the other hand, contribution is not only time consuming, but is also seen as a threat to individual employee viability" (Bukowitz and Williams, 1999). Unless the organizational environment rewards knowledge sharing, the entire effort to institutionalize a knowledge management system will falter. These aspects are discussed in more detail in Chapter Five.

Collaboration is another key process that should permeate the organizational knowledge management approach. What organization does not have task forces, committees, project teams, or work groups? The manner in which a modern organization is governed, the way curricula are determined, and the statements written in institutional policies all inexplicitly involve the expectation that individuals work collaboratively. Groupware activities, including sharing of calendars, collective writing, e-mail handling, shared database access, electronic meetings with each person able to see and display information to others, among others, contribute to facilitating virtual and easy collaboration.

To share the knowledge is not nearly the end of knowledge management. What often fails in knowledge management is the inability to shepherd the entire process. Szulanksi (1994) found four barriers to successful sharing and transferring of knowledge: ignorance on both ends of the transfer, absorptive capacity, lack of relationship between the giver and receiver, and slow rate of adoption. Many corporations have tuned in to these four barriers. These potential hidden obstacles hampering knowledge management have been widely recognized by corporations. Another painful truth is that even though some organizations have been managing knowledge in one form or another, they have not organized the knowledge in a meaningful fashion. Therefore, organizations and employees have been struggling with a convoluted potpourri of data, information, and knowledge without specific mechanisms to leverage their power. Organizing knowledge in a meaningful taxonomy is a challenging task, especially in large organizations with many different individual and group needs. At the same time, the access to knowledge must be relatively easy. A well-thought-out taxonomy

would definitely facilitate the ease of access as would notification mechanisms and personalization of information. As described in Chapter Three, well-developed portals can address most of these concerns and processes.

Finally, the ultimate test of any knowledge management system is its use. The best-built portal structure will have little value if the employees do not use it. Some institutional researchers may have experienced the frustration of developing and deploying decision support systems only to find themselves providing the same reports that one could easily obtain from available systems. As with any new endeavor, resistance to change is one of the barriers to successful implementation of knowledge management systems. However, if the perceived (and actual) benefits of such systems are greater than the perceived effort to learn a new tool or adopt a new model of operation, then the chances of success are very high.

Relevance of Knowledge Management for Higher Education and Institutional Research

In many institutions of higher education, there is no organized knowledge management system in place or even an understanding of such a system (Kidwell, Vander Linde, and Johnson, 2000). Since higher education is about the creation, transformation, and transmission of knowledge (Laudon and Laudon, 1999), such an oversight is striking. However, some colleges and universities are making good progress in this direction, as described in the following chapters.

Kidwell, Vander Linde, and Johnson (2000) are among those who conceptualized the potential applications and benefits of knowledge management for higher education. In the area of faculty, student, and curriculum development, for example, they advocated for portal-based access to a repository of pedagogy and assessment techniques, student evaluations, and curriculum revision efforts. Benefits of such access could range from enhanced quality of curriculum and programs to improved responsiveness in incorporating ideas from best practices to improved administrative intervention. For research-related knowledge management, they envisioned a repository or a portal for research outcomes, preformatted proposals and budget forms, as well as overview of internal services, resources, and staff. The benefit could be less redundancy and expedited research applications that leverage existing research efforts. They also detailed knowledge management applications for administrative services and strategic planning. Chapter Three provides a detailed discussion of the features and advantages of portal technologies for higher education institutions and exemplifies how a college has put into practice some of the conceptual models proposed by these authors.

Whereas Chapter Three focuses primarily on internal knowledge management, Chapter Four discusses customer relationship management

(CRM), an aggressive and mission critical knowledge management tool that provides institutions with the framework and technology needed for tracking and communicating with their clients, including prospective and current students and their parents and alumni. CRM puts organizational knowledge to the test by facilitating real-time interaction between customers and the service provider. CRM recognizes relationships as the key components in organizational operations. Relationships exist everywhere in higher education. The most important relationship is between faculty and students. Higher education as an entity for knowledge creation and transfer can learn from CRM by focusing on the relationship between students (the learners) and the college (the knowledge provider). Our learners have become more demanding, their needs more diverse, and they are more vocal in expressing their wishes. Colleges cannot survive by simply opening the door and waiting for students to walk in to enroll. If you build it, they may *not* come.

Von Holzen (2000) stated that new education models will soon emerge. Sullivan (2001) went a step further to indicate the possibility of current education providers being replaced by for-profit entities should they be slow to change. Currently, growth-oriented institutions are focusing on enrollment management. Whereas this is an important area, it will not be entirely effective by itself, perhaps because it tends to make the admissions office the focal point but leaves out everything else that a learner experiences, receives, and interacts with in their "whole experience." Instead of thinking of managing enrollment, the focus might be better placed on managing the relationship between the learner and the college or university. One direction to take is to expand the notion of enrollment management or collapse many existing enrollment projects under the notion of "learner relationship management" (LRM) (Luan, 2001). Just like the paradigm shift from teaching to learning, the shift from narrowly focused enrollment management to learner relationship management is profound. The theories of learning and the notion of accountability notwithstanding, the entire process of providing learning is, first of all, a relationship. Learner relationship management will prompt the college or university to proactively examine a whole suite of issues, factors, information, and knowledge related to the various relationships centering on the needs of learners. Identifying and satisfying the needs of learners are among the most effective means to handle enrollment, retention, marketing, student success, and a host of accountability related issues, henceforth, *knowledge management*.

Institutional research is an empirical example of how explicit knowledge management applies. Institutional research relies primarily on two sources: explicit data and existing literature. Data are either from data warehouses or quantitative or qualitative information obtained from surveys, interviews, and focus groups. Research literature typically refers to learned experiences and tried methodologies. Researchers either develop a new methodology or replicate what already exists. Institutional research has

always intuitively followed the process of transforming data into information and further into knowledge. The textbook description of a researcher has always been one who frames a research question, reviews the literature, identifies a sample of data, develops a hypothesis, tests the hypothesis, and writes up the findings. Some may go further to provide policy recommendations. Most of what researchers perform today still fits this scenario, but with heightened intensity, speed, and skills.

The institutional research field is under constant change in the area of explicit knowledge enhanced by technologies. From a data management perspective, the data warehousing industry has expanded dramatically over the last two decades. It is a fast-developing enterprise that has left the confines of a few privileged corporations (mainly those who could afford it) to be widely available for implementation. It is not rare to see data warehouses with terabytes of data at some American universities. Data mining, discussed in detail in the next chapter, has pushed the envelope further by linking sophisticated pattern recognition through direct communication with a data warehouse deployed over the Web. The Internet has fundamentally changed the way we display information or access data. Printed hard copies of reports have given way to on-line real-time query results, or soft copies. The Internet will drive software, not the other way around. A significant amount of a researcher's time is in the area of designing and maintaining reports for decision making. Researchers have to split their time between data warehousing and querying and, in the near future, among data mining, building and maintaining portals, and managing documents and contents.

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