Knowledge management and reference services

Smiti Gandhi, Senior Research Librarian

Harcourt Education in Orlando, Florida, United States

Available online 11 August 2004.

Abstract

Many corporations are embracing **knowledge management** (KM) to capture the intellectual capital of their employees. This article focuses on KM applications for reference work in **libraries.** It defines key concepts of KM, establishes a need for KM for reference services, and reviews various KM initiatives for reference services.

Article Outline

What is knowledge management?
The information continuum
Data
Information
Knowledge
Wisdom
KM's four essential components
The role of knowledge in KM
The role of management in KM
The role of IT in KM
The role of corporate culture in KM
Data management, information management, and KM
Data management
Information management
Knowledge management
The KM process
Knowledge acquisition
Knowledge inventory
Link knowledge to corporate strategy
Knowledge map
Knowledge collection and organization
Knowledge access and dissemination
Knowledge application
KM and reference services—needs analysis
KM applications for reference services
Frequent question card files
Knowledge-based ESs

Knowledge repositories
Electronic listserv's, USENET newsgroups, and collaborative reference
Data mining and data warehousing applications
Analysis of KM applications for reference services
Information versus knowledge
Knowledge as an asset
Lack of systematic and logical approach
Who are the experts?
Capture explicit versus tacit knowledge
Focus on Product versus Process
Build it and They Will come
Not linked to organizational strategy or performance
Conclusion
References

Knowledge management (KM) emerged as a business trend in the 1990s and continues to evolve a decade later. Its fundamental premise is that enormous amounts of knowledge about customers, processes, products, and services exist at all levels of an organization, and if this cumulative knowledge can be captured and communicated, it can help organizations become more productive, effective, and successful.[1] Eighty percent of the world's largest companies are engaging in KM.[2] Corporations such as Ford, Eastman Kodak, Chevron, Digital Equipment Corporation, Hewlett-Packard, Chrysler, Amoco, Dow, Texas Instruments, Gartner Group, and Arthur Andersen are experimenting with, and benefiting from, KM initiatives.[3] Organizational “knowledge repositories” such as Andersen's Knowledge Exchange, Booz, Allen & Hamilton's Knowledge Online, CAP Gemini's Knowledge Galaxy, Ernst & Young's Center for Business Knowledge, and Monsanto's Knowledge Management Architecture enable information sharing among employees and facilitate access to company-wide information.[4] In 2004, the market for KM tools is expected to reach US$9.8 billion.[5]

In recent years, KM has also become visible on the radar screens of libraries. Library and information science publications are increasingly, including KM articles, and professional associations such as the Special Libraries Association and American Society for Information Science are offering publications, seminars, and conferences on KM.[6] At the core of the KM discourse in library and information science is the belief that since organization of knowledge has been the strong suite of librarians, they must not only engage in, but also actively spearhead, KM initiatives.

This article explores how KM is being applied to reference work in libraries. To this end, key concepts about knowledge and KM are examined. The first part of the paper analyzes the relationships among data, information, knowledge, and wisdom. It goes on to show how an understanding of the role of KM's four principal components: knowledge, management, information technology (IT), and corporate culture, as well as the difference among data management, information management, and KM is key to effective KM. The second part of the article focuses on KM applications for reference services in libraries. A needs analysis is followed by an examination of various historical and current KM initiatives and a critique of some aspects of KM applications for reference services. In conclusion, a KM framework for reference is outlined.

What is knowledge management?

Definitions of KM abound. Simply defined, KM is “organizing to know.”[7] It is a concerted effort to capture critical knowledge, share information within an organization, and capitalize on the collective organizational memory to improve decision making, enhance productivity, and promote innovation. It “involves capturing the knowledge, the wisdom, the added value experiences of individuals within an organization, making it easy to find again, and in so doing preserving it as an organizational asset.”[8] KM is an attempt “to turn employee's knowledge (human capital) into a shared, firmwide asset (structural intellectual capital).”[9]

The goal of KM is to create a learning and sharing organization by linking together and creating a flow between the buckets of information generated by people in different parts of the company—finance, operations, competitive intelligence, etc.[10] Most people and organizations engage in KM for one or more of the following reasons:

• enhance collaboration;

• improve productivity;

• enable and encourage innovation;

• cope with information overload and deliver only the essentials;

• facilitate the flow of appropriate knowledge from providers to receivers without the constraints of time and space;

• facilitate information sharing among employees and prevent them from having to reinvent the wheel every time;

• capture and record the knowledge of employees before they leave the company, ensuring that valuable expertise does not leave when an employee leaves;

• increase an organization's awareness of the gaps in its knowledge;

• help companies stay competitive by increasing their awareness of strategies, products, and best practices of their competitors; and

• improve customer service.[11]

KM has two parts: first, the management of data and information; and second, the management of individuals who possess specific expertise, abilities, or knowledge.

> KM has two parts: first, the management of data and information; and second, the management of individuals who possess specific expertise, abilities, or knowledge

[12] These two parts—content and people—are integrated with the help of specific processes and technology to facilitate KM.[13] Benchmarking, capturing best practices, creating learning organizations, developing learning communities, data mining, fostering culture change,

improving workflow, and systematically gathering competitive and business intelligence are just few of the tools, practices, interventions, and infrastructure-based approaches organizations have embraced to manage knowledge and information.[14]

The two constituent terms of KM—"knowledge" and "management"—are integrated with the help of its two enablers—technology and corporate culture to harness the collective memory of organizations. To understand KM, it is vital to understand the following:

• the information continuum and the distinction among data, information, knowledge, and wisdom;

• the role of KM's four essential components—knowledge, management, technology, and corporate culture;

• the difference among data management, information management, and KM; and

• the KM process.

The information continuum

The information continuum progresses along four stages—data, information, knowledge, and wisdom—that are related to each other in terms of context and the understanding of relationships and patterns they impart or require.[15]

Data

Data are the raw materials—the observations, facts, or figures—from which information is obtained. Typical examples of data include statistics, lists of items, and lists of names and addresses.[16] Statistics about the number of earthquakes worldwide, or the number of people who had the flu, or the number of people hurt on the job every year, are all data. Similarly, lists of all the materials that a library has in its collection, as well as lists of the names and addresses of library staff or patrons, are also data. Each library collects a tremendous amount of data every day about the items patrons check-out. During a typical check-out transaction, a library system may collect the following data elements: the name, address, and phone number of the patron, number of library materials checked out, the format of materials checked out (books, videos, etc.), titles of materials checked out, fines if any on the account, etc.

Data itself are relatively devoid of context. For example, the name of a particular book is the name of a book regardless of whether it appears in the library's online public access catalog (OPAC), a magazine article, a publisher's catalog, or on an advertising bulletin.

Information

When data are organized in a logical, cohesive format for a specific purpose, it becomes information. So, data about earthquakes that occurred in the United States and were above 6.5 on the Richter scale will be considered information. Similarly, if one were to extract data about how many people between the ages of eighteen and thirty-five had the flu, or how many people actually died of job-related injuries, it would become information. Examples of information in the library environment could include a list of all the materials that were added

to the OPAC in the last three months; a bibliography of all the materials used to answer a specific reference question; a list of patrons who checked out more than five books in a certain time period; or a list of the most frequently checked out books.

Data are also converted to information when it is placed in a meaningful context and helps in understanding the relationships between different data elements. For example, a five-year comparison of the statistical data about the number of earthquakes, incidences of the flu, or on-the-job injuries will provide information about whether the numbers went up or down. Similarly, a comparison of the number of items listed in a library's OPAC for each of the past five years will yield information about whether the collection is growing or not. By comparing check-out transaction lists at a particular library, it is possible to obtain information about how many items in various formats were checked out during a specific time frame.

Knowledge

Knowledge is stage three in the four-stage continuum from data to wisdom. When information is analyzed, processed, and placed in context, it becomes knowledge. Knowledge involves making inferences and recognizing unusual patterns, hidden trends, and exceptions in the data and information.[17] It involves creating a mental model of the pattern or trend that can be applied with a degree of reliability and predictability in a particular context.[18] Knowledge is an elusive and complex process that requires an individual to make value judgments based on prior experiences and understanding of the patterns.[19] Based on this prior experience and understanding, an individual may have formulated certain if–then rules which can be applied with a degree of predictability to similar situations.

For example, a knowledgeable geologist may look at the information on earthquakes and be able to discern the conditions and factors that make certain geographic areas more prone to strong earthquakes. Similarly, a knowledgeable health worker may look at the information related to the incidence of flu in eighteen- to thirty-five-year-olds and deduce that eighteen- to thirty-five-year-olds who have children or work closely with children are more likely to catch the flu. At a library, a knowledgeable librarian may observe that all new materials added to the library in the past six months on authors like Edgar Allan Poe, Amy Tan, Alice Walker, and Nathaniel Hawthorne not only get checked out right away but constantly remain checked out. Or patrons who check-out more than five books are also the heaviest interlibrary loan users. Or students who attend formal library instruction or orientation sessions as part of the curriculum are more likely and willing to use electronic databases and ask librarians for help.

Wisdom

When knowledge is applied to make and improve decisions, processes, and productivity, or to yield profits, it is transformed into wisdom. Wisdom requires individuals to be willing and able to absorb information, evaluate, and reflect on that information, decide whether or not to use that information for the specific problem or situation, and understand why they made that decision.[20] To be wise, individuals must not only possess knowledge, but must also have a thorough understanding of the principles embodied within that knowledge.[21] A health worker who discovers the relationship between the incidence of flu among eighteen- and thirty-five-year-olds and people who work with children may decide to mount a hygiene campaign targeted at eighteen- to thirty-five-year-olds who work with children. Or a librarian who

discovers that students who attend library orientation sessions also use the library more frequently may decide to approach administration and prepare a plan so that all incoming freshmen students are required to take library orientation sessions.

In summary, data, information, knowledge, and wisdom are four stages along the information continuum. Data are devoid of context and consist of observations, facts, or figures from which information is obtained. When data are organized for a specific purpose and placed in context, it becomes information. When information is analyzed to reveal unusual patterns or hidden trends, it is transformed into knowledge; and when knowledge is applied to real life situations to make decisions, it becomes wisdom.

KM's four essential components

KM has four critical components—knowledge, management, IT, and corporate culture. Each one of these components plays a significant role in KM and can have a tremendous impact on its success or failure.

The role of knowledge in KM

Addleson states, "People have always had knowledge and always used it."[22] But what exactly is knowledge? Knowledge is the "knowing" embedded in people's experiences, skills, expertise, competencies, capabilities, talents, thoughts, ideas, ways of working, intuitions, and imaginations that manifests itself in the form of the tangible artifacts, work processes, and routines in an organization.[23]

There are two principal kinds of knowledge—explicit, and tacit or implicit. Explicit knowledge is knowledge that has been "codified" or "fixed in some format," i.e., explained, recorded, or documented, and therefore can be shared easily with users. Explicit knowledge may be codified or "fixed" in the form of manuals, written procedures, business records, magazine, or journal articles, books, Web pages, databases, intranets, e-mails, notes, graphic representations, or audio and visual materials. When knowledge is "fixed" or codified, a knowledge artifact is created, and it is this knowledge artifact that can be managed.[24]

Tacit or implicit knowledge is the personal, unarticulated, unexpressed knowledge possessed by an individual. It is "the stuff between people's ears—the know-how, the little tricks, the intuition, the judgment, the stuff that makes things work."[25] Simply put, it is the knowledge and expertise that a person has gained over the years through experience, by interacting with others, and through trial and error. This knowledge resides only in a person's head or in his personal notes, computer files, or desk drawers. It has never been completely articulated, recorded, documented, or written down in a format understandable to people other than the individual himself. It is estimated that 80 percent of the most important knowledge is tacit knowledge.[26]

A reference librarian, for example, may possess a great deal of tacit knowledge about how to answer difficult reference questions such as what is in a love bug that causes paint to discolor/peel on a car; or the size of the egg of a tapeworm; or the name of the agency that can help to find matches for single, missing shoes. However, this knowledge is accessible to others only if the reference librarian chooses to share it with her colleagues through formal and informal conversations, or through detailed notes, an article, or book about the process

involved and the best sources used. Similarly, standard reference sources such as the *Statistical Abstract of the United States* or *Nineteenth Century Literary Criticism* are available to any library user. However, knowing when and how to use these resources to answer specific reference questions is tacit knowledge that reference librarians possess.

Almost all activities people engage in require some combination of explicit and tacit knowledge. For effective KM, it is essential to capture both tacit and explicit knowledge.

For effective KM, it is essential to capture both tacit and explicit knowledge

The real challenge of KM lies in being able to identify and capture tacit knowledge so that it can be retrieved when needed. However, while explicit knowledge is easy to record and transfer, tacit knowledge is difficult to identify, capture, and transmit. Therefore, most organizations concentrate on managing the 20 percent of the explicit knowledge available, leaving it to coincidence that tacit knowledge is used.[27]

Although converting tacit knowledge to explicit knowledge is difficult, it is not impossible. Tacit knowledge is generally transmitted in the form of stories about best practices, which are often documented and put on a network and are subsequently used by other employees to learn and improve processes.[28] At PayMaxx, the CEO successfully converted his employees' tacit knowledge to explicit knowledge by asking all employees to write down step-by-step directions for everything they did, thus forcing them to record knowledge they had internalized as experience or memory. This helped to create detailed road maps of all processes for colleagues and successors and even unearthed weaknesses that needed to be addressed.[29]

For KM projects to be successful, it is important to differentiate between information and knowledge. Not all information is knowledge. Information cannot become knowledge until it is analyzed and acted upon, and it will only be acted upon in the right organizational culture.[30] While most organizations and employees suffer from information overload, they do not suffer from knowledge overload. On the contrary, there is a dearth of knowledge. One of the biggest challenges of KM lies in being able to make sense of the mountains of information, sifting out valuable information, and sharing it.

The role of management in KM

Management is associated with something that "has connotations of systemizing, providing structure, and contributing an overall sense of coherence to an organization."[31] Other attributes of management include coordination, control, integration, and the judicious use of people, processes, and strategies to achieve a goal. In KM, the principal goal is to manage explicit and tacit knowledge within an organization. To manage explicit knowledge, organizations must

• generate, create, or acquire knowledge;

• codify and organize knowledge to facilitate easy access;

• make knowledge available to others through communication or publications;

• facilitate access to, and retrieval of, knowledge; and

• use and apply knowledge to solve problems, support decisions, improve performance, coach, and analyze situations and processes to support business activities.[32]

Tacit knowledge can be managed in two ways. It can be converted to explicit knowledge, through written communications, interviews, and oral histories. Organizations can also create "knowledge communities" or "communities of practice" to transfer tacit knowledge through face-to-face interaction, verbal communication and dialogue, hands-on instruction, interactive problem solving, networking, coaching, mentoring, training, and professional development opportunities. In the traditional reference environment, tacit knowledge is usually transferred through knowledge communities or communities of practice.

The role of IT in KM

IT can serve as a powerful enabler of, and provide effective and efficient tools for all facets of KM including capturing, sharing, and applying knowledge.[33] The ability of IT applications to search, index, collate, archive, and transmit information can greatly facilitate and improve information collection, organization, classification, and dissemination.[34] Technologies such as relational database management systems, document management systems, the Internet, intranets, search engines, workflow tools, performance support systems, decision support systems (DSSs), data mining, data warehousing, e-mail, video-conferencing, bulletin boards, news groups, and discussion boards can play a pivotal role in facilitating the management of knowledge. However, IT in itself is not the "heart" of KM and a project is not a KM project simply because it utilizes or incorporates the latest IT applications.[35] IT only plays a supporting role in KM; it alone does not provide knowledge. While IT can assist people in locating information, people have to determine whether that information is appropriate and relevant to their particular need.[36] They have to analyze, interpret, understand, and place that information in context for it to be converted to knowledge.

The role of corporate culture in KM

One of the most important enablers of KM is an "open" corporate culture that encourages people to interact with each other, share ideas, experiences, and viewpoints and be heard without fear of reprisals.[37] The absence of a corporate culture that encourages collaboration, trust, knowledge sharing, listening, learning, and creativity can be a major barrier in developing and implementing a successful KM project. Davenport et al. assert, "if the cultural soil is not fertile for a knowledge project, no amount of technology, knowledge content, or good project management practices will make the effort successful."[38] Jerry Junkins, the late CEO of Texas Instruments said, "Transferring best practices is not like transplanting a begonia. It's more like an organ transplant, often rejected by the immune system as "not me!" In companies, the immune system is the culture, and if the culture is not receptive, best practices, however good, will be rejected."[39]

Without the wholehearted commitment of top-level management, the KM initiative will flounder and ultimately perish. Management support must be forthcoming in fiscal, personnel, and technical resources, as well as with adequate training opportunities and reward systems. Goman suggests KM initiatives often fail because "All too often team leaders withhold information and dole it out on a 'needs to know' basis, executives ask for collaborative input when what they really want is a 'rubber stamp' for decisions already made, and people are not sharing what they know due to a variety of personal and organizational inhibitors."[40]

The success of KM projects will depend on the collaboration and knowledge sharing between all participants, and all participants must be actively engaged in collecting and contributing content to the projects. However, if employees are penalized instead of being rewarded for sharing their knowledge, they will not contribute to the KM effort. Goman, O'dell, and Grayson suggest that people are often reluctant to share their knowledge because they may:

• be too busy;

• not wish to take on additional responsibilities that come with sharing;

• be assigned to projects that do not utilize their talents or aptitudes;

• feel that sharing knowledge will hinder their personal success;

• feel outranked and intimidated in team discussions and think they have nothing to contribute;

• not trust others with their knowledge or that they will reciprocate by sharing their knowledge;

• feel threatened and "punished" for contributing if their opinions are ridiculed, criticized, or ignored; or

• work for managers and decision makers who withhold information from them.[41]

Each of the four components of KM—knowledge, management, IT, and corporate culture—plays a vital role in any KM initiative and has the potential to significantly impact its success. Knowledge is the explicit and tacit know-how that people acquire through personal experience. Successful KM initiatives try to manage this explicit and tacit knowledge by recording or codifying it or transferring it through knowledge communities or communities of practice. IT serves as a tool to help with capturing, organizing, sharing, and applying knowledge. An open corporate culture that encourages sharing of ideas and best practices and the transfer of knowledge is a critical enabler of KM.

Data management, information management, and KM

Organizations have utilized computers to manage data and information since the 1950s. In libraries, computers have been used primarily to automate and efficiently manage processes such as circulation, cataloging, serials, acquisitions, interlibrary loans, and bibliographic information retrieval. However, in the 1990s, dramatic hardware and software improvements significantly enhanced the ability of computers to store, manage, manipulate, and provide access to data and information. These improved capabilities of computers have spurred their use for KM activities in organizations.

> ...improved capabilities of computers have spurred their use for KM activities in organizations

Data management

Some of the earliest examples of computerized data management systems are Transaction Processing Systems (TPSs). In the mid 1950s, organizations started using TPSs to automate manual, repetitive processes and collect data associated with daily transactions such as payroll, inventory control, ordering, billing, etc. TPSs were simple applications that provided limited types of information, primarily in the form of lists or summaries of transactions.[42]

Data management systems were first used in libraries for automating circulation and serial records, cataloging, indexing, interlibrary loans, and assisting in the retrieval of bibliographic information. According to a Special Libraries Association survey, by 1966, data processing equipment was being used by 209 libraries, primarily for serials management and acquisitions. In addition, 131 libraries were using data processing systems for reference or document retrieval.[43] By the late 1960s, a number of libraries had also begun to develop first-generation OPACs to enhance bibliographic information retrieval. These early OPACs were "known item" finding tools that provided few access points (typically only author, title, and control number) to short nonstandard bibliographic records."[44] Since these first-generation OPACs had limited functionality, and did not assist users in discerning patterns or relationships between the various data elements, they are best characterized as data management systems.

Information management

In the 1970s and 1980s, the introduction of database management technology provided a major impetus to information management. Relational database management systems (DBMSs) enhanced the functionality of TPSs and permitted users to rearrange and present data and information in new and creative ways. With this flexibility, users were able to discover correlations between data elements. For example, users could discover relationships between sales of specific products and the times of the year.[45]

DBMSs found several information management applications in libraries. In the 1970s and 1980s, they led to the development of second-generation OPACs, such as the University of Illinois at Urbana Champaign's OPAC, with greatly enhanced bibliographic information retrieval and data manipulation capabilities. Users could search not only by author and title, but could also search by subject headings, keywords, Boolean operators, and cross references. In addition, they could restrict searches to specified record fields and limit results by date, language, place of publication, etc.[46] The flexibility of picking and choosing fields to search by enabled users to combine and rearrange data elements in various permutations and combinations, and thus discover correlations between data elements.

During these two decades, a number of information management and retrieval systems for improving access to periodicals, newspapers, and other nonbook sources were also developed. Online bibliographic databases, indexing and abstracting databases, and full-text databases were introduced and began proliferating. Databases and online retrieval services such as DIALOG, BRS, OCLC, WILSONLINE, VU/TEXT, MEDLINE, Chemical Abstracts Online (CAS), InfoTrac, Lexis, Nexis, ERIC, NTIS, Dun's Market Identifiers, AGRICOLA, and the electronic edition of the *Academic American Encyclopedia* made their debut and began to permeate reference work.[47]

In the 1990s, the number of online databases containing bibliographic citations, indexes, abstracts, and full-text expanded exponentially. The number of online databases grew from 40 in 1972 to 300 in 1979; 2800 in 1987; 5300 in 1994; and to as many as 12,000 in 2001.[48]

This phenomenal growth led to online databases becoming an integral part of reference services in libraries. In addition to online databases, the World Wide Web also became a key component of reference work in the 1990s.

Even though OPACs, online databases, and the World Wide Web have proliferated tremendously over the last several decades and have become an integral part of reference work in libraries, they are still essentially information management systems. IT applications in libraries have simply changed the way that libraries package, store, and provide access to information. Instead of card catalogs, libraries now provide access to their holdings through OPACs; instead of print journals, newspapers, directories, and encyclopedias, libraries provide access to this information through online databases and World Wide Web gateway sites. However, OPACs, online databases, and the World Wide Web still deal with the collection, codification, classification, and organization of information. These processes increase the user's access to information but do not provide any value-added or special insights to the user. They do not help a user make inferences, recognize unusual patterns, hidden trends, or exceptions in the data and information they find. As Borgman states, "Information Retrieval systems are little more than a set of elaborate matching routines performed very quickly on a high speed computer; the system cannot 'think' in the same manner that humans can."[49]

For example, a user searching a library's OPAC may find a list of fifty books on nuclear proliferation in a matter of seconds. However, it is up to the user or the librarian to determine which is the best book for his particular information need. Similarly, a user may find lots of full-text articles in *WilsonSelect* or *Encyclopedia Britannica Online* on a particular topic, but the online databases do not provide any knowledge to the user as to which article is the best or which database would be the most appropriate for his particular information need. Knowledge about best sources or best practices is tacit knowledge that librarians may have acquired through experience, but it is not transmitted to users through information management systems like the OPACs, online databases, and the World Wide Web.

Knowledge management

KM is not merely information collection, organization, presentation, storage, and retrieval. While information and data management are important components of KM, KM differs from information and data management due to its emphasis on collaborative learning, capture of tacit knowledge, and value-add obtained through best practices and data mining.[50] Early IT applications for KM took the form of decision support systems (DSSs) and expert systems (ESs). The goal of these systems was to utilize IT applications to either improve human decision making or replace it entirely. As KM evolved, it was recognized that human decision making is a form of individual expertise and cannot be supplemented or replaced by IT.[51] This realization led to a quantum shift to "expertise-centered management."[52] The focus of KM shifted from trying to supplement or replace human expertise to trying to encourage and facilitate its sharing.[53]

Unlike data management and information management systems, KM does not have a specific computer or IT associated with it.[54] KM may utilize one or more of a host of IT applications such as data warehousing, data mining, enterprise information portals, document management systems, groupware, DSSs, intranets, Lotus notes, search engines, e-mail, content management systems, and collaborative applications. Of these, data mining

applications perhaps have the greatest potential for KM since they can help users identify unusual patterns or hidden trends in the data that are not otherwise apparent.[55]

In summary, data management, information management, and KM are interrelated but distinct operations.

> ...data management, information management, and KM are interrelated but distinct operations

Data management systems automate manual, repetitive processes related to daily transactions within an organization and provide limited types of information. Information management systems allow users to manipulate and rearrange the data to a certain degree and thereby help them discover correlations between data elements. Information management is inextricably integrated into today's libraries in the form of OPACs, online databases, and the World Wide Web. Even though data management and information management may be important components of KM, the ultimate objective of KM systems is to promote collaborative learning and sharing within organizations.

The KM process

KM is not a linear, static process. On the contrary, it is a dynamic, cyclical process that requires employees to continuously engage with information, acquire new knowledge, apply it to improve decisions, create new information and knowledge in the process, apply that new knowledge to new situations, and so on.[56] Three things are central to the KM process. First, people have to possess knowledge; second, they have to be willing to use that knowledge; and third, they have to have the ability and wisdom to know when to apply or use that knowledge.[57] The KM process consists of the following steps:

Knowledge acquisition

The basic premise of KM rests on attempting to capture and codify the explicit and tacit knowledge of employees. If employees do not possess knowledge, there will be no need for KM. Therefore, the first step in the KM process is knowledge acquisition by employees.

Knowledge inventory

An organization cannot manage information or knowledge that it does not know about. Therefore, an organization engaging in KM must first take a “knowledge inventory” and explicitly tabulate its knowledge assets.[58] It does not need to create an inventory of all its knowledge, but focus on identifying knowledge that is critical, highly valuable, reliable, and useful to the organization or business unit such as the following:

• knowledge of a specific job or task, e.g., how to do reference work;

• a list of subject or task level experts who have the best qualifications, latest training, or expertise to best perform certain jobs/tasks;

• a list of experts who can solve particular types of problems that have the potential to reoccur;

• knowledge of historical precedents—have certain processes been tried before and what was their outcome;

• knowledge of customers and competitors; and

• knowledge about creating successful project teams—knowing who has the skill sets for similar projects and has worked together successfully in the past.[59]

Link knowledge to corporate strategy

The third step in the KM process is to link the knowledge inventory to key business processes that drive corporate strategy or performance. Key business processes may include product development, service enhancement, customer management, sales, etc.[60] This step will assist in discerning the most critical and vital knowledge elements required for key business processes and will help to filter out knowledge that is only peripheral or tangentially important. Based on this step, the knowledge inventory can be refined to create a hierarchical representation of critical and peripheral data elements.

Knowledge map

The fourth step in the KM process is to create a knowledge map. This involves capturing the key inputs and outputs of knowledge. Key inputs may include specific data and information, verbal or written communications, and other shared explicit and tacit knowledge such as best practices. Key outputs may be internal documents, reports, research papers, procedures, internal benchmarks, and best practices.

Knowledge collection and organization

The fifth step in the KM process focuses on developing a process to systematically capture, record, and organize the key inputs and outputs of knowledge and to find, collect, and organize internal knowledge and best practices.

Knowledge access and dissemination

The collection and organization of best practices and other knowledge are meaningless if users do not have access to it when they need it. Therefore, the sixth step in the KM process focuses on creating a mechanism to improve access to this knowledge so that it can be retrieved, disseminated, shared, understood, and used repeatedly.

Knowledge application

As users apply best practices to new situations to improve performance, they will adapt, refine, and modify those practices and create new best practices. The final step in the KM process involves capturing these new best practices and adding them to the KM application so that they can be made available to users in the future.[61]

To summarize, KM is a dynamic, cyclical process that moves through several stages. Employees acquire knowledge in the knowledge acquisition phase. The organization tabulates its knowledge assets and creates a knowledge inventory. This knowledge inventory

is linked to organizational strategy. Subsequently, key inputs and outputs of the knowledge are mapped, systematically collected, and organized. A process is developed for providing access to and disseminating the knowledge and best practices collected. Users access and apply this knowledge to improve performance and generate new knowledge in the process, which is collected and so on. Most KM projects do not try to manage all the knowledge that exists within an organization. A majority of KM projects focus on managing the knowledge embodied within a single business unit, area, or domain.[62] The following sections of this paper will focus on the application of KM to reference services in libraries.

KM and reference services—needs analysis

Euster states, "The glory of libraries lies in their ability to gather together new and established information and knowledge, and to maintain them in an organized fashion that is stable and reliable."[63] Libraries have fulfilled this mission remarkably well and have become vast repositories of information. In the process, they have generated a considerable amount of information and knowledge about internal operations and processes, including reference services. Reference librarians have long recognized the need to capture, codify, record, and "fix" the collective knowledge of their colleagues in some sort of explicit knowledge artifact. This need stems from three principal realities of reference work:

• Reference librarians in libraries across the United States and the world answer thousands of questions every day.

• Reference librarians manage to answer only 50–60 percent of the questions correctly; therefore, there is immense potential to improve services and learn from each other by sharing correct answers.

• It has long been recognized that librarians cannot remember all sources.

Reference librarians answer tens of thousands of questions every day. In some library systems librarians may respond to ten million plus questions per year.[64] To answer these thousands of questions, reference librarians consult a vast number of information resources in a variety of formats such as reference books, periodicals, pamphlets, newspapers, circulating books, vertical files, picture files, outside sources, the library catalog, electronic databases, and the Internet.

In the process of helping users locate relevant information, librarians have amassed enormous amounts of tacit knowledge about print, electronic, and community resources. They have internalized knowledge about resources and tools most appropriate for each query, as well as the reference process used to find these resources. However, it is virtually impossible for any single reference librarian to have complete recall of all the materials in his or her library collection, keep up with the constant flow of new materials, and consistently remember the best sources for answering specific reference questions.[65]

O'Dell suggests, "The next best thing to knowing something is knowing where and how to find it—just in time."[66] Reference librarians know where and how to find information when it's needed only about half the time. This is reflected in the results of more than forty unobtrusive surveys of ready reference questions in public and academic libraries in the United States, England, Australia, Canada, New Zealand, and Germany, which reveal that

reference librarians managed to provide correct answers to only about 50–60 percent of these questions.[67]

While no single librarian can consistently keep track of or remember the best sources of information for all reference questions asked, collectively reference librarians possess tremendous knowledge about various reference processes and information sources to answer a multitude of queries. KM systems are needed to tap into this "communal knowledge" of librarians.

KM systems are needed to tap into this "communal knowledge" of librarians

Waters, in an article about the National Agricultural Library's (NAL) attempts at developing a "computerized expert system" to assist users in obtaining answers to questions on agricultural topics, wrote:

"No single librarian is capable of remembering the best sources for locating answers to all the questions asked at a typical library reference desk. Tools are needed to assist reference librarians in their work. These tools could aid end users themselves in locating either appropriate information sources or the specific answers to their questions without professional assistance. An expert system that serves as such a tool could free librarians to handle complex queries requiring in-depth effort and relieve them of the more ready reference and directional questions. It could also be used to stem 'brain drain' by acquiring and making available the special and local knowledge of reference librarians who are leaving the library."[68]

In addition to serving as buffers against the imperfect memories of librarians, allowing librarians to focus on more complex queries, and stemming brain drain, KM systems for reference work also have several other benefits. Such systems can help reference librarians to

• systematically collect, organize, and record the explicit and tacit knowledge of expert reference librarians;

• quickly and efficiently locate answers to frequently asked questions, or questions that are difficult and time consuming to answer;

• improve decisions about the best reference sources to consult for answering a particular question;

• improve knowledge sharing;

• acquire in-depth knowledge of their library's collection;

• understand the types of questions they get asked most often and the various information resources available in their library to answer those questions;

• improve collection development—determine which questions they do not have sufficient resources on, and address gaps in their library collection; and

• improve patron access to information. A KM system users can search themselves can guide them to appropriate resources or specific answers without assistance from a librarian.

The high volume of questions reference librarians deal with daily, an average success rate in answering reference questions correctly, and the limitations of the human memory, collectively establish a firm need for reference librarians to adopt collaborative sharing and learning initiatives such as KM. Corporate and academic libraries are beginning to recognize the benefits of KM initiatives and tap into their potential.

KM applications for reference services

Over the years, reference librarians have made some attempts to collect, organize, codify, and "fix" their internal information and knowledge and share it with their colleagues or users through formal and informal KM initiatives. These initiatives span the gamut from informal, paper-based, loosely organized card–files of frequently asked questions, to technologically sophisticated applications such as ESs and data mining tools.

Frequent question card files

Early attempts to capture the collective memory of reference librarians were rather informal and generally consisted of information about elusive or repeatedly asked queries recorded on index cards that were filed either alphabetically or by subject. Known by a variety of names—quick reference file, hard question file, fugitive file, query file, rough-reference file, useful reference file, information file, file of answered questions, vertical file—these card files recorded very basic information or hints. There was no systematic attempt at collecting, recording, editing, or updating information. Most contributions were voluntary, and staff contributed items as and when they deemed appropriate. As early as 1897, Eleanor B. Woodruff provided guidance on what to include in the card files and suggested that staff record the following:

• all materials that were found with difficulty, i.e., those that took a long time to find, or were found in sources that were not obvious;

• references to questions asked frequently or repeatedly;

• odds and ends of useful information that staff picked up during the course of their reading;

• information or items not easily located through indexes; and

• any information or items that staff were likely to need in the future but would be at a loss to find again.[69]

Grogan suggested that librarians also include in the card file specialized information of local interest and queries that could not be answered despite a thorough search.[70] Miller recommended that the card file include references to community resources and people with special talents or interests who may be able to assist with answering certain reference queries.[71]

Although there is anecdotal evidence that ready reference card files existed in almost every library, there is very little systematic study or evaluation of these card files in the library literature. The few cases reported in the library literature suggest that the "ready reference" card files at some libraries were very large and were designed to supplement existing

reference tools. For example, the ready reference files at the Chicago Public Library filled as many as 200 filing cabinet drawers and according to a 1982 study by Bronwyn P. Parhad were used to answer 30 percent of the 1000 phone queries received every day.[72] The fugitive files at the University of Minnesota Libraries in Twin Cities comprised of thirty-six hanging file folders in 1999.[73] Perez characterizes these "frequent question" card files as "beta-test knowledge-bases."[74] A number of ready reference files, such as those at the University of California at Los Angeles, were computerized in the 1980s.[75] In 1992, the ready reference card file at California State University, Long Beach (CSULB), was automated to provide keyword access to 800 tidbits of elusive information. Any CSULB reference librarian could add records to, or search this automated reference file.[76]

Knowledge-based ESs

In addition to ready reference files, university and public libraries developed many prototype knowledge-based ESs in the 1980s and 1990s to assist librarians with simple fact-type questions. These knowledge-based ESs basically consisted of three components: an interface module where a user could ask a question; a knowledge base comprising of if–then rules that an expert librarian would follow; and an inference engine that specified how the if–then rules applied to the user's particular query.[77]

One of the earliest ESs was Pointer. Developed by the State University of New York Buffalo's Government Documents department, Pointer guided users through a series of menus to help them select a reference resource for their particular government documents query. Answerman, an ES developed by the National Agricultural Library, guided users to reference sources likely to answer questions related to agriculture. Plexus, an ES for the domain of gardening, employed a natural language interface and guided users to reference resources, personal specialists, and institutions related to gardening. The Online Reference Assistance developed by the University of Waterloo mimicked a librarian in answering factual questions. It suggested strategies for literature searches, explained how to find whether specific documents were in the library, and helped in filling out interlibrary loan forms.[78] Other subject-specific ESs include the following: Research Advisor for business, education, and economics; Reference Advisory System for law, life sciences, medicine, and public health; TomeSearcher for business, computer science, electrical engineering, IT, and material science; Pronto for law; Patent Information Assistant for patents; Cansearch for cancer research; and CHEMREF for chemistry.[79]

Knowledge repositories

Corporate and special libraries are leading the way in developing knowledge repositories.

> Corporate and special libraries are leading the way in developing knowledge repositories

The WebLibrary at Digital Equipment Corporation evaluates, analyzes, synthesizes, qualifies, and delivers externally created content to 1500 corporate library users worldwide. WebLibrary is a Web-based corporate intranet that serves as the delivery vehicle for online pathfinders, electronic content created through specific business partnerships, tailored views of news, market research, technical information, and other information and knowledge that impacts business decisions.[80] Kalliope, developed by librarians at Hewlett-Packard, is a KM repository "of internal documents written by software engineers in support of their software

development activities." It is a knowledge access tool on the corporate intranet that captures, stores, indexes, and tracks thousands of documents created and used repeatedly by 1500 software engineers working in various labs in at least four geographical regions. Kalliope allows engineers to search for, locate, retrieve, and share documents quickly and efficiently.[81] The SunLibrary provides KM services to Sun MicroSystems through its corporate intranet, SunWeb.[82] The Oak Ridge National Laboratory Library is engaged in KM initiatives to improve access to strategic knowledge throughout the organization. It is piloting a Virtual Proposal Support Center to "increase access to knowledge about grants and proposals of interest to Oak Ridge." Intended as a one-stop shopping center for scientists, the Virtual Proposal Support Center will allow them to search multiple databases for grants and proposals, retrieve lists of experts available to support a proposal, and access similar proposals and lessons learned. In addition, scientists will be able to retrieve the same types of knowledge from collaborating institutions.[83] Corporate librarians at Aventis Pharmaceuticals have built a global information portal to facilitate knowledge sharing between 65,000 employees' worldwide. Through the portal, users can access information about 1000 resources, searchable archives of daily news stories, industry newsletters, and other information pertinent to the company.[84]

Recent KM initiatives in academic libraries include Refquest, the Common Knowledge Database (CKDB), the Reference Desk Manager, and the Reference Desk Program. Refquest, a searchable Internet-based reference information knowledge base developed by the Ithaca College Library, permitted natural language searching of 200 reference questions entered from the library's "frequently asked" questions file, questions of current and future interest, and interesting questions. It provided short summary answers to the reference questions, together with notes, lists of reference sources, pertinent Web sites, pointers to materials in library collections elsewhere, and contact information for other organizations as well as human experts.[85] CKDB was developed by librarians at the New Brunswick Campus Libraries of Rutgers University to facilitate knowledge sharing between various campuses. It focused on acquiring, collecting, and sharing information and knowledge useful for reference librarians.[86] Librarians at Oregon State University designed Reference Desk Manager, a Web-enabled, keyword searchable KM database that replaced information previously recorded in card files, manuals, and clipboards. It contains frequently asked questions, information, and resources for class assignments, important policies and procedures, e-mails, addresses, phone numbers, and URL's of frequently used local resources.[87] The Faculty Database, Reference Desk Program, and Collection Development Helper are KM databases developed at Cal Poly library to assist librarians in their work. The Reference Desk Program is an online Web-based database where librarians can record information about class assignments, difficult questions, and problems. This information was previously recorded in card files and clipboards kept at the reference desk.[88]

A clearer understanding of the difference between KM approaches in corporate and academic libraries can be obtained by placing them in the context of Peter Drucker's two incarnations of knowledge: "Knowledge applied to the new is innovation; and knowledge applied to the existing processes, services, and products is productivity."[89] KM efforts in corporate libraries incorporate both incarnations since they promote innovation and help to increase productivity. KM initiatives in academic libraries focus primarily on the second incarnation and are geared towards improving productivity and knowledge sharing between reference librarians.

Electronic listserv's, USENET newsgroups, and collaborative reference

Reference librarians have also taken advantage of the World Wide Web to build online communities of practice through e-mail listservs, USENET newsgroups, discussion boards, and collaborative digital reference applications to manage and share their collective knowledge. Stumpers, an electronic listserv created in 1992, is an Internet-based mailing list that allows librarians to consult with hundreds of colleagues throughout the world about difficult or sticky reference questions. Therefore, a question that may seem impossible to answer to one librarian may very easily be answered by another librarian who has either tackled it before or knows the answer due to a personal interest in that particular subject area. In 1994, more than 700 reference librarians subscribed to Stumpers and 50–100 questions were exchanged every day through the listserv. The questions and answers exchanged are stored in a searchable archive for future use and retrieval.[90]

In addition to Stumpers, reference librarians have also developed online communities of practice such as specialized USENET newsgroups on various subjects. Questions that recur frequently in a newsgroup are collected, answered, put through an intense peer review and revision process, and posted to FAQ files of the newsgroup.[91] These FAQ files become knowledge repositories that can be tapped into repeatedly.

Reference librarians are also harnessing the power of the World Wide Web to create collaborative reference programs. One such program was the Collaborative Digital Reference Service (CDRS), a pilot program started by the Library of Congress and sixteen partner libraries in early 2000.[92] CDRS was a question-and-answer system that utilized customer relationship management software (CRM). It notified libraries worldwide about reference questions needing to be answered and routed questions to appropriate libraries. This provided librarians with access to library collections beyond their own collections, hence improving the likelihood of the question getting answered. Questions and answers were stored in an archive database.[93] By 2002, when CRDS ceased operations, it had 260 participating libraries.[94]

CDRS was replaced by QuestionPoint, a collaborative effort of OCLC and the Library of Congress. Launched in June 2002, QuestionPoint is a collaborative network of reference librarians throughout the world who lend their expertise to answer reference questions. After library patrons submit a question on QuestionPoint, it files, tracks, and manages the questions; automatically routes questions to appropriate libraries locally, in consortia or cooperatives, and/or to international libraries in the Global Reference Network; and constructs a searchable Global Knowledgebase of asked and answered reference questions. In 2003, QuestionPoint had 300 member libraries, and over 3000 question and answer sets in its Global Knowledgebase.[95]

Through electronic listservs like stumpers, USENET newsgroups, and collaborative reference services like CDRS and QuestionPoint, reference librarians are engaging in KM by creating knowledge repositories, improving knowledge access, and enhancing the knowledge environment. By writing down answers to difficult reference questions in e-mail and Web-based responses, reference librarians are recording the explicit knowledge about particular sources, as well as tacit knowledge that they had internalized about where to look for the information, and creating knowledge artifacts that can be managed and reused.

Data mining and data warehousing applications

Data mining and data warehousing applications have been used by the corporate world as DSSs for more than a decade. However, libraries are just beginning to tap into their potential. In 2003, Barbara Mento and Brendan Rapple surveyed 124 members of the Association of Research Libraries (ARL) to determine the extent to which they were using data mining technologies. Of the sixty-five respondents, 26 or 40 percent did use data mining and 38 or 58 percent believed that data mining could be a valuable tool. However, most libraries are using data mining and data warehousing to strengthen administrative decision making by facilitating the collection and analysis of data pertaining to door count statistics, circulation, interlibrary loans, collection development, acquisitions, electronic resource usage, and Web usage patterns.[96] For example, the MIT data warehouse contains data on collection management, cataloging, and serials' management.[97] Similarly, Indiana University libraries data warehouse contains data about circulation statistics, acquisition statistics, and title/volume counts for the collection.[98] The Vanderbilt University library data mining effort focuses on collecting Web usage statistics with the help of the Web Trends software.[99]

With respect to reference services, data mining and data warehousing is being used either to facilitate library users' research by mining the Web and building large repositories of information resources, or tracking usage patterns for Web and electronic services. One example of a repository of information resources is INFOMINE, a virtual library of evaluated Internet resources such as databases, electronic journals, e-books, bulletin boards, mailing lists, OPACs, articles, directories or researchers, and other information.[100] The library literature reviewed did not yield any examples of data mining or data warehousing initiatives in libraries that focussed on collecting and analyzing patterns about the internal knowledge of reference librarians and the services they provide. None of the applications systematically collected, analyzed, or tried to discover patterns in how reference librarians answered specific reference questions, the process they followed, their success and failure rates in answering questions, and the explicit and tacit knowledge that they accumulated and transmitted or recorded.

In summary, reference librarians recognize the benefits of KM and of collaborative and knowledge sharing activities. They have attempted to collect, organize, codify, “fix,” and share their internal explicit and tacit knowledge through KM initiatives such as frequent question card files, knowledge repositories, electronic listservs, newsgroups, collaborative reference, data mining, and data warehousing applications. Although these early KM efforts are a step in the right direction, KM initiatives in libraries have a long way to go and have tremendous potential for improvement.

Analysis of KM applications for reference services

Although libraries are starting to embrace KM, it has not been widely integrated into the business processes of most libraries. Very few libraries are initiating “real-life” KM projects that are linked to the corporate business strategy. Stratigos suggests that these early KM efforts represent “more of a grass-roots approach to KM than anything systematically organized from the top.”[101] After analyzing fifty-three knowledge-based ESs for general reference work, Richardson concluded that real or commonsense knowledge was not present in any of the systems, primarily due to the dearth of expert knowledge. He suggested that since the fifty-three prototype systems were capable of assisting reference librarians with some basic, fact-type questions, these systems were more appropriately classified as “assistants” rather than expert KM systems.[102] KM systems developed in libraries thus far suffer from one or more of the shortcomings discussed in the following analysis.

Information versus knowledge

Perhaps the biggest shortcomings of KM initiatives in libraries stems from the confusion surrounding the terms “information” and “knowledge”

> Perhaps the biggest shortcomings of KM initiatives in libraries stems from the confusion surrounding the terms “information” and “knowledge”...

and how each of these terms relate to the term “management.”[103] Many library and information science professionals equate KM with the organization of knowledge.[104] However, as discussed earlier in this article, the mere organization of knowledge is not KM—it is information management. While some librarians consider information tools like the library catalog as beta-test knowledge bases,[105] a clearer understanding of the distinction between information and knowledge would lead to the classification of the library catalog as an example of information management rather than KM.

Knowledge as an asset

Davenport et al. identify four broad types of objectives for KM projects: “(a) create knowledge repositories, (b) improve knowledge access, (c) enhance knowledge environment, and (d) manage knowledge as an asset.”[106] Most KM applications for reference services revolve around the first three objectives, creating knowledge repositories, improving access, and enhancing the knowledge environment. Very few focus on managing knowledge as an asset that can add value or produce a return on investment.

Lack of systematic and logical approach

Successful KM systems must be grounded in a systematic and logical approach.[107] However, most KM initiatives in libraries have not followed a systematic and logical approach/process to identify, organize, or share internal knowledge or best practices to improve the operational effectiveness of the library.[108] Very few libraries have explicitly tabulated their knowledge assets or created knowledge inventories and knowledge maps of their internal knowledge. As evidenced from the KM systems discussed above, librarians contributed best practices and knowledge to the KM databases on a purely voluntary basis. The only criterion for adding information to the KM database was the perceived need/value of such information by a particular reference librarian.

Who are the experts?

As mentioned earlier, knowledge acquisition is the first step in the KM process. For successful KM systems for reference, it is critical to identify reference librarians who are experts in their subject domains, are willing to share their knowledge, and whose knowledge can be coded for computerized systems.[109] According to Richardson's rule, only 5 percent of the reference librarians can be considered experts; another 10 percent are really good; and 85 percent are MLS competent.[110] Many KM systems developed thus far have not made a concerted effort to identify experts either internally within a particular library or externally in the overall library community. They have also failed to capture the knowledge of the 15 percent truly expert or good reference librarians.

Capture explicit versus tacit knowledge

Successful KM systems try to capture both explicit and tacit knowledge. Most KM systems in libraries focus on capturing the explicit knowledge of reference librarians—e.g., what information is available on a particular topic, where is it available, and what are the best sources for a specific query. Typically, this information is compiled in the form of a bibliography or list and added to a searchable computerized or Web-based database. However, these KM applications do not satisfactorily or systematically capture and codify the tacit knowledge of reference librarians—knowing how to find information, where information is available, how to select the right sources, when to use a certain source, how to follow a trail of clues to get to the right information, etc.

Focus on Product versus Process

Most KM initiatives in libraries have been project oriented rather than process oriented. They have focussed more on building specific products or applications rather than refining reference work to create a process that actively generates and communicates knowledge. Reference librarians continue to employ the basic reference process that has the following steps:

a. Library user articulates problem.

b. Librarian analyzes the query to determine information need.

c. Librarian negotiates question.

d. Librarian identifies and selects specific reference tools that may provide answer to the query.

e. Librarian selects reference sources that provide answer.

f. Librarian communicates information selected to the library user.

g. If user is satisfied with answer, the process is terminated here. If user is not satisfied, librarian renegotiates query and repeats steps c through f.[111]

Successful KM initiatives help an organization to establish internal benchmarks, identify and record best practices, and create an environment of continuous learning.

> Successful KM initiatives help an organization to establish internal benchmarks, identify and record best practices, and create an environment of continuous learning

KM systems implemented in libraries so far have not achieved these goals. They have not led to a restructuring of the basic reference process to either improve its efficiency, uncover flaws in the process, or streamline it. To establish internal benchmarks, identify best practices, and promote continuous learning, reference librarians will need to integrate KM into, and add an additional step to, the reference process—that of recording/debriefing and failure analysis after completing each reference transaction. They must make a concerted effort to record reference interactions in detail and analyze and provide expert commentary on successful as well as unsuccessful reference queries. To learn from the process and avoid repeating mistakes, it is vital to record what worked, what did not work, which steps in the

process were useful, and what would they do differently next time. In the absence of this additional step of debriefing and failure analysis, reference librarians will be unable to improve the reference process and the performance of their work.[112]

Build it and They Will come

O'Dell and Grayson emphasize that "just creating databases will not cause change to happen."[113] KM initiatives for reference will not succeed if they are not tied to specific goals or objectives within the library or the larger organization. The goals may be to improve communication between reference librarians, prevent them from reinventing the wheel, or to share knowledge with patrons. Perkins cautions "Don't assume that if you build it, they will come. First ask, what is the business problem that this application is trying to solve? If you can't find an acceptable answer, don't do it."[114]

Not linked to organizational strategy or performance

Another shortcoming of KM initiatives in libraries is that a majority of them are not explicitly linked to organizational strategy or performance. Very little effort has been made to understand how the best reference practices apply to, add value to the work of, and are used by different stakeholders. Are they valuable to users? To librarians? To the larger organization of which the library is a part? Is there empirical evidence of this? There is also no concerted attempt to analyze how KM initiatives add value to reference services and promote future innovation and improvements in either the reference process, the library, or organization as a whole. Also lacking is a systematic evaluation of how KM initiatives assist in adapting and applying best practices to new situations and to improve and streamline them.

To summarize, KM initiatives in libraries can be further improved by critically analyzing them and addressing several shortcomings. For more efficient KM systems that can yield greater benefits, it is vital that libraries engaging in KM clearly understand the distinction between information management and KM and learn to treat knowledge as an asset. They must also adopt a systematic and logical approach based on the KM process, identify the internal and external knowledge experts, and focus on capturing and making available tacit as well as explicit knowledge. Libraries engaging in KM for reference services must also focus on refining the reference process to include failure analysis, establishing clear goals, and linking KM initiatives to organizational strategy and performance.

Conclusion

KM initiatives have the potential to assist libraries in capturing, collecting, organizing, and disseminating the collective memory and wisdom of reference librarians and helping them become more productive, effective, and customer service oriented. KM can also help libraries streamline their day-to-day operations, improve their visibility and involvement in the larger organization, and assume a leadership role in helping to capture the institutional memory. However, successful KM initiatives require a clear understanding of the information continuum; the four key components of KM; the distinction between data management, information management, and KM; and the KM process. KM initiatives are most likely to be introduced and succeed at libraries that function as learning communities, have strategic goals, a knowledge sharing culture, the versatility to accept new challenges and try different approaches, and the ability to harness the power of IT. To develop KM initiatives for reference services, librarians and library administrators must

• Identify the core mission and goals of why a library provides reference services

• Identify what kind of knowledge is vital and essential either to provide core services or improve services

• Determine who has this knowledge, or if nobody has it, then how can this knowledge be acquired. In other words, identify the experts. This is the knowledge acquisition phase

• Put processes in place so that this knowledge can be used to improve the core mission and goals of the reference service

• Create processes so that reference librarians know:

• What knowledge is available

• Who has it, i.e., who are the experts

• How can it be used or applied to a particular situation or context

• How can it be mapped, captured, and "fixed" as a knowledge artifact

• How can it be made easily accessible for reuse by others

• How can it be refined further and added to, to improve future processes.

Since "knowledge and knowledge processes are inextricably tied to the function, structure, culture, and mission of an organization,"[115] an effective KM strategy will require libraries to develop an in-depth understanding of the domain of knowledge and how it is used within their broader organization. Reference librarians will have to "shift (their mental models) from custodians of a document collection to managers of the corporate memory."[116] They must move beyond the role they have always excelled at—finding, selecting, organizing, and managing information—to creating and managing knowledge. They must move beyond being "administrative workers" who organize things for others to access and become true "knowledge workers" who use knowledge as a dominant aspect of their work and possess high levels of skills and expertise.[117]

References

1. Carol Kinsey Goman, "Five Reasons People Don't Tell What They Know," *Knowledge Management CRM Magazine* (June 22, 2002). http://www.sciencedirect.com/science?_ob=RedirectURL&_method=externObjLink&_locator=url&_cdi=6556&_plusSign=%2B&_targetURL=http%253A%252F%252Fwww.kmmag.com%252Fprint%252Fdefault.asp%25253FArticleID%25253D960 (accessed February 21, 2004).

2. Steve Barth, "KM Horror Stories," *Knowledge Management CRM Magazine* (September 14, 2000). http://www.sciencedirect.com/science?_ob=RedirectURL&_method=externObjLink&_locator=url&_cdi=6556&_plusSign=%2B&_targetURL=http%253A%252F%252Fwww.destinationkm.com%252Fprint%252Fdefault.asp%25253FArticleID%25253D923 (accessed February 21, 2004).

3. T. Kanti Srikantaiah, "Knowledge Management: A Faceted Overview," in *Knowledge Management for the Information Professional*, edited by T. Kanti Srikantaiah & Michael E.D. Koenig (Medford, NJ: Information Today, 2000), pp. 1–17; Carla O'Dell & C. Jackson Grayson, "Identifying and Transferring Internal Best Practices," *Knowledge Management CRM Magazine* (July 16, 2001) http://www.sciencedirect.com/science?_ob=RedirectURL&_method=externObjLink&_locator=url&_cdi=6556&_plusSign=%2B&_targetURL=http%253A%252F%252Fwww.destinationkm.com%252Fprint%252Fdefault.asp%25253FArticleID%25253D271 (accessed February 21, 2004).

4. Yogesh Malhotra, "From information management to knowledge management: Beyond the Hi-Tech hidebound systems" In: T. Kanti Srikantaiah and Michael E.D. Koenig, Editors, *Knowledge management for the information professional*, Information Today, Medford, NJ (2000), p. 40.

5. Barth, "KM Horror Stories" (September 14, 2000).

6. Srikantaiah, "Knowledge Management," (2000) 8–9.

7. Mark Addleson, "Organizing to know and to learn: Reflections on organization and knowledge management" In: T. Kanti Srikantaiah and Michael E.D. Koenig, Editors, *Knowledge management for the information professional*, Information Today, Medford, NJ (2000), pp. 137–160.

8. Ernest Perez, "Knowledge management in the library—not", *Database Magazine* **22** (1999, April/May) (2), pp. 75–78.

9. Thomas A. Stewart and David C. Kaufman, "Getting real about brainpower", *Fortune* **132** (1995, November 27) (11), pp. 201–203.

10. Ibid., p. 202.

11. Srikantaiah, "Knowledge Management," p. 15; Vikas Sahasrabudhe, "Information Technology in Support of Knowledge Management", in *Knowledge Management for the Information Professional*, edited by T. Kanti Srikantaiah & Michael E.D. Koenig (Medford, NJ: Information Today, 2000), pp. 269–276.

12. David C. Blair, "Knowledge management: Hype, hope, or help?", *Journal of the American Society for Information Science and Technology* **53** (2002, October) (12), p. 1021.

13. Anthea Stratigos, "Knowledge management meets future information users", *Online* **25** (2001, January/February) (1), p. 65.

14. Thomas Short, "Components of a knowledge strategy: Keys to successful knowledge management" In: T. Kanti Srikantaiah and Michael E.D. Koenig, Editors, *Knowledge management for the information professional*, Information Today, Medford, NJ (2000), pp. 351–352.

15. Ian Watson, *Applying Knowledge Management: Techniques for Building Corporate Memories* (Boston, MA: Morgan Kaufman, 2003), p. 7; Blair, "Knowledge Management: Hype, Hope, or Help?" 1020.

16. Blair, "Knowledge Management: Hype, Hope, or Help?" 1020; Australian Bureau of Statistics, "Definitions: Data, Information & Statistics." http://www.sciencedirect.com/science?_ob=RedirectURL&_method=externObjLink&_locator=url&_cdi=6556&_plusSign=%2B&_targetURL=http%253A%252F%252Fwww.abs.gov.au%252FWebsitedbs%252FD3310116.NSF%252F4a255eef008309e44a255eef00061e57%252F0fd3f28bf578d9784a2567ac00195104!OpenDocument (accessed February 21, 2004).

17. Watson, *Applying Knowledge Management*, p. 8; Jonathan Wu, "Business Intelligence: The Transition of Data into Wisdom," *DM Direct* (November 2000). http://www.sciencedirect.com/science?_ob=RedirectURL&_method=externObjLink&_locator=url&_cdi=6556&_plusSign=%2B&_targetURL=http%253A%252F%252Fwww.dmreview.com%252Fportal_ros.cfm%25253FNavID%25253D91%252526EdID%25253D2524%252526PortalID%25253D17 (accessed December 24, 2003).

18. Ibid.; Gene Bellinger, Durval Castro, & Anthony Mills, "Data, Information, Knowledge, and Wisdom." http://www.sciencedirect.com/science?_ob=RedirectURL&_method=externObjLink&_locator=url&_cdi=6556&_plusSign=%2B&_targetURL=http%253A%252F%252Fwww.systems-thinking.org%252Fdikw%252Fdikw.htm (accessed December 24, 2003).

19. Blair, "Knowledge Management: Hype, Hope, or Help?" (October 2002) 1021.

20. Stratigos, "Knowledge Management Meets," (January/February 2001) 65.

21. Bellinger, Castro, Mills, "Data, Information, Knowledge, and Wisdom (2004).".

22. Addleson, "Organizing to Know," (2004) 140.

23. Gary Southon and Ross Todd, "Library and information professionals and Knowledge Management: Conceptions, challenges, and conflicts", *Australian Library Journal* (2001, August), p. 261.

24. Claire McInerney, "Knowledge Management and the Dynamic Nature of Knowledge", *Journal of the American Society for Information Science and Technology* **53** (2002, October) (12), p. 1012.

25. David Stamps, "Is knowledge management a Fad?", *Training* **36** (1999, March) (3), p. 40.

26. Ibid., p. 40.

27. Ibid., p. 40.

28. Stewart & Kauffman, “Getting Real About Brainpower,” (November 27, 1995), 203.

29. Bronwyn Fryer, “Get Smart”, *Inc.* **21** (1999, September 14) (13), pp. 60–61.

30. Stamps, “Is Knowledge Management a Fad?” (March 1999), 36.

31. Addleson, “Organizing to Know,” 2000, 138.

32. Sahasrabudhe, “Information Technology,” 2000, 270.

33. Ibid., p. 269.

34. Malhotra, “From Information Management to Knowledge Management,” 2000, 53.

35. Addleson, “Organizing to Know,” 2000, 155; Sahasrabudhe, “Information Technology,” 2000, 270.

36. Addleson, “Organizing to Know,” 2000, 155–156.

37. Ibid., p. 153.

38. Thomas H. Davenport, David W. De Long and Michael C. Beers, “Successful Knowledge Management Projects”, *Sloan Management Review* **39** (1998), pp. 43–57 Winter. Abstract-INSPEC | $Order Document

39. Stamps, “Is Knowledge Management a Fad?” p. 37.

40. Goman, “Five Reasons” (June 22, 2002).

41. Ibid.; O'Dell & Grayson, “Identifying and Transferring Internal Best Practices.”.

42. Blair, “Knowledge Management: Hype, Hope, or Help?” 1023.

43. Johannah Sherrer, “Implications of new and emerging technologies on reference service” In: Gary M. Pitkin, Editors, *The impact of emerging technologies on reference service and bibliographic instruction*, Greenwood Press, Westport, CT (1995), p. 42.

44. Charles R. Hildreth, “Extending the Access and Reference Service Capabilities of the Online Public Access Catalog,” in *Questions and Answers: Strategies for Using the Electronic Reference Collection*, edited by Linda C. Smith. (Papers Presented at the 1987 Clinic on Library Applications on Data Processing, April 5–7, 1987), p. 18.

45. Blair, “Knowledge Management: Hype, Hope, or Help?” (October 2002), 1023.

46. Hildreth, “Extending the Access,” 20.

47. Sherrer, “Implications of New,” 42–45; Dianne Rothenberg & Mima Spencer, “Full-Text Databases: Implications for Libraries,” in *Questions and Answers: Strategies for Using the Electronic Reference Collection*, edited by Linda C. Smith. (Papers Presented at the 1987 Clinic on Library Applications on Data Processing, April 5–7, 1987), pp. 85–87; Virgil P.

Diodato, "Online Ready Reference in Academic Libraries: Current Practices and Review of Planning Issues," in *Questions and Answers: Strategies for Using the Electronic Reference Collection*, edited by Linda C. Smith. (Papers Presented at the 1987 Clinic on Library Applications on Data Processing, April 5–7, 1987), p. 65.

48. Christyn Billinsky, "Online Database Searching," in *Principles and Applications of Information Science for Library Professionals*, edited by John N. Olsgaard (Chicago: American Library Association, 1989), 69; Sherrer, "Implications of New," 46; Carol Tenopir, "Database and Online System Usage," *Library Journal* 126, no. 16 (October 1, 2001): 41.

49. Denis Grogan, *Practical reference work* (2nd ed.), Library Association Publishing, London (1992), p. 134.

50. Blair, "Knowledge Management: Hype, Hope, or Help?" 1026; TFPL Ltd., *Skills for Knowledge Management* (London: TFPL, 1999), http://www.sciencedirect.com/science?_ob=RedirectURL&_method=externObjLink&_locator=url&_cdi=6556&_plusSign=%2B&_targetURL=http%253A%252F%252Fwww.lic.gov.uk%252Fpublications%252Fexecutivesummaries%252Fkmskills.html (accessed February 21, 2004).

51. Blair, "Knowledge Management: Hype, Hope, or Help?" (October 2002), 1023.

52. M. Broadbent, "The phenomenon of knowledge management: What does it mean to the information profession?", *Information Outlook* (1998, May), pp. 23–26.

53. Blair, "Knowledge Management: Hype, Hope, or Help?" (October 2002), 1023.

54. Robert Craig, "KM Comes of Age," *ENT* 5, no. 7 (April 26, 2000): 36; John B. Dykeman, "Knowledge Management Moves From Theory Towards Practice," *Managing Office Technology* 43, no. 4 (May 1998): 12.

55. Mitch Betts, "Unexpected Insights," *Computerworld* (April 14, 2003): 34; Wu, "Business Intelligence.".

56. Stratigos, "Knowledge Management Meets," (January/February, 2001), 65.

57. F.C. Gray Southon, Ross J. Todd and Megan Seneque, "Knowledge Management in Three Organizations: an Exploratory Study", *Journal of the American Society for Information Science and Technology* **53** (2002) (12), p. 1055.

58. Blair, "Knowledge Management: Hype, Hope, or Help?" (October 2000), 1027.

59. Watson, *Applying Knowledge Management*, p. 11; Blair, "Knowledge Management: Hype, Hope, or Help?" 1026.

60. Stewart & Kauffman, "Getting Real About Brainpower," (November 27, 1995), 201.

61. O'dell & Grayson, "Identifying and Transferring Internal Best Practices," (July 16, 2001).

62. Watson, *Applying Knowledge Management*, (2003), p. 11.

63. Joanne R. Euster, “It's academic”, *Wilson Library Bulletin* **69** (1995, March), pp. 62–63.

64. John V. Richardson, *Knowledge-based Systems for General Reference Work: Applications, Problems, and Progress* (San Diego, CA: Academic Press), (1995), p. 73.

65. Cherie B. Weil, *Classification and Automated Retrieval of Biographical Reference Books* (M.A. Thesis, University of Chicago, 1967), p. 3; Gerald Jahoda & Judith Schiek Braunagel, *The Librarian and Reference Queries: A Systematic Approach* (New York: Academic Press, 1980), p. 1; Richardson, *Knowledge-based Systems*, p. 263; Joy Thomas and Stephen P. Sottong, “Automating Your Ready Reference File,” *Reference Services Review* 22, no. 1 (Spring 1994): 89.

66. Stamps, “Is Knowledge Management a Fad?” 38.

67. Richardson, *Knowledge-based Systems*, p. 136; Grogan, *Practical Reference Work, 2nd ed.*, pp. 177–78; Jahoda & Braunagel, *The Librarian and Reference Queries*, pp. 85–86; Elizabeth Thomsen, *Rethinking Reference: The Reference Librarian's Practical Guide for Surviving Constant Change* (New York: Neal-Schuman Publishers, Inc.), (1999), pp. 211–213.

68. Samuel T. Waters, “Answerman, the expert information specialist: An expert system for retrieval of information from library reference books”, *Information Technology and Libraries* **5** (1986, September) (3), p. 204.

69. Grogan, *Practical Reference Work, 2nd ed.*, (1992), pp. 124–25.

70. Denis Grogan, *Practical reference work*, Clive Bingley Ltd., London (1979), p. 99.

71. Shirley Miller, *The vertical file and its satellite: A handbook of acquisition, processing, and organization* (2nd ed.), Libraries Unlimited, Littleton, CO (1979), p. 210.

72. Grogan, *Practical Reference Work, 2nd ed.*, (1992), p. 125.

73. Susan Diane Gangl, “The librarian's library: Fugitive reference files, staff-only pathfinder files at the University of Minnesota”, *Reference Librarian* **72** (2001), p. 182.

74. Perez, “Knowledge Management in the Library—Not,” (April/May, 1999), 76.

75. Grogan, *Practical Reference Work, 2nd ed.*, (1992), p. 125.

76. Thomas, Sottong, “Automating Your Ready Reference File,” 89–90.

77. Grogan, *Practical Reference Work, 2nd ed.*, (1992), p. 125.

78. Robert Carande, Automation in Library Reference Services: a Handbook, Greenwood Press, Westport, CT (1992), pp. 77–81.

79. Richardson, *Knowledge-based Systems*, (1995), pp. 76–77.

80. Mary Lee Kennedy, "Building Blocks for Knowledge Management at Digital Equipment Corporation: The WebLibrary", *Information Outlook* **1** (1997, June), pp. 39–42.

81. Susan K. Charles, "Knowledge management lessons from the document trenches", *Online* **26** (2002, January/February) (1), pp. 22–28.

82. Cynthia Hill, "Insourcing the outsourced library: the sun story", *Library Journal* **123** (1998, March 1) (4), pp. 46–48.

83. Charles Thomas Townley, Knowledge management and academic libraries, *College & Research Libraries* **62** (2001, January) (1), p. 52.

84. Sharon Srodin and June Strupczewski, "Creating a Global Information Portal: Our 9-Month Odyssey", *Computers in Libraries* **22** (February 2002) (2), pp. 15–19.

85. Perez, "Knowledge Management in the Library—Not," (April/May, 1999), pp. 76–77.

86. Ronald C. Jantz, "Knowledge management in academic libraries: Special tools and processes to support information professionals", *Reference Services Review* **29** (2001) (1), pp. 33–39.

87. John C. Matylonek, Carolyn Ottow and Terry Reese, "Organizing ready reference and administrative information with the reference desk manager", *D-Lib Magazine* **7** (2001, November) (11) http://www.sciencedirect.com/science?_ob=RedirectURL&_method=externObjLink&_locator=url&_cdi=6556&_plusSign=%2B&_targetURL=http%253A%252F%252Fwww.dlib.org%252Fdlib%252Fnovember01%252Fmatylonek%252F11matylonek.html (accessed February 21, 2004).

88. Paul T. Adalian Jr. and Judy Swanson, "Locally developed web-enabled databases: New roles and opportunities for libraries", *Reference Services Review* **29** (2001) (3), p. 246.

89. Short, "Components of a Knowledge Strategy" (2000), 245–247.

90. Renee Olson, "Stumped Reference Librarians Find Help on the Internet," *American Libraries* (October 1994): 830–831; Thomsen, *Rethinking Reference*, (1999), p. 103.

91. Thomsen, *Rethinking Reference*, (1999), p. 103.

92. Barbara Quint, "QuestionPoint Marks New Era in Virtual Reference", *Information Today* **19** (2002, July/August) (7), p. 50.

93. Rachel Lynn Wadham, "Virtual reference", *Library Mosaics* **12** (2001, November/December) (6), p. 20.

94.Quint, "QuestionPoint Marks New Era," (July/August, 2002) 50.

95. Ibid., pp. 50, 54; Mick O'Leary, "QuestionPoint Fortifies Libraries in Internet Age," *Online* 27, no. 3 (May/June 2003): 70–72; Barbara Quint, "The Digital Library of the Future," *Information Today* 19, no. 7 (July/August 2002): 10–11; OCLC, QuestionPoint.

http://www.sciencedirect.com/science?_ob=RedirectURL&_method=externObjLink&_locator=url&_cdi=6556&_plusSign=%2B&_targetURL=http%253A%252F%252Fwww.oclc.org%252Fquestionpoint%252Fdefault.htm (accessed February 15, 2004).

96. Barbara Mento and Brendan Rapple, *SPEC Kit 274: Data mining and data warehousing*, Association of Research Libraries, Washington, DC (2003, July), pp. 9–13.

97. *MIT Data Warehouse Reports*, http://www.sciencedirect.com/science?_ob=RedirectURL&_method=externObjLink&_locator=url&_cdi=6556&_plusSign=%2B&_targetURL=http%253A%252F%252Fweb.mit.edu%252Fwarehouse%252Fmetadata%252Freports%252Fbusiness_area%252Flibraries.html (accessed February 21, 2004).

98. *Indiana University Libraries Web/LMIS*, http://www.sciencedirect.com/science?_ob=RedirectURL&_method=externObjLink&_locator=url&_cdi=6556&_plusSign=%2B&_targetURL=http%253A%252F%252Fwww.indiana.edu%252F%2520libdwfp%252FWebLMIS%252Findex.html (accessed February 21, 2004).

99. Vanderbilt University, *Jean and Alexander Heard Library: Web Statistics*, http://www.sciencedirect.com/science?_ob=RedirectURL&_method=externObjLink&_locator=url&_cdi=6556&_plusSign=%2B&_targetURL=http%253A%252F%252Fstaffweb.library.vanderbilt.edu%252FWebTrends (accessed February 21, 2004).

100. Mento & Rapple, *SPEC Kit 274*, pp. 46, 66; INFOMINE: Scholarly Internet Resource Collections. http://www.sciencedirect.com/science?_ob=RedirectURL&_method=externObjLink&_locator=url&_cdi=6556&_plusSign=%2B&_targetURL=http%253A%252F%252Finfomine.ucr.edu%252F%25253Fview%25253Dabout (accessed February 21, 2004).

101. Stratigos, "Knowledge Management Meets," (January/February, 2001), 65.

102. Richardson, *Knowledge-based Systems*, pp. 77, 82, 289, 253–294.

103. Southon, Todd, & Seneque, "Knowledge Management in Three Organizations," (2002), 1049.

104. J. Rowley, "Owners of the Knowledge," *Library Association Record* 101, no. 8 (1999): 475; Robert Schwarzwalder, "Librarians as Knowledge Management Agents," *Econtent* 22, no. 4 (August/September 1999): 63–65; D. Streatfield & T. D. Wilson, "Deconstructing Knowledge Management," *Aslib Proceedings* 51, no. 3 (1999): 67–71; Elisabeth Davenport & Blaise Cronin, "Knowledge Management: Semantic Drift of Conceptual Shift?" *Journal of Education for Library and Information Science* 41, no. 4 (Fall 2000): 294; J. Crosby, "The Missing Link," *Information Outlook* (September 1999): 42; K. Lieberman, "Knowledge Management or Library 101: Is There a Difference? (SIG MGT), in *ASIS '99: Proceedings of the 62nd ASIS Annual Meeting, Vol. 36, Knowledge: Creations, Organization, and Use*, ed. L. Woods (Medford, NJ: Information Today, Inc., 1999), p. 850.

105. Perez, "Knowledge Management in the Library—Not," 76.

106. Davenport, De Long, Beers, "Successful Knowledge Management," (Winter, 1998), 40.

107. Richardson, *Knowledge-based Systems*, (1995), p. xiii.

108. Jantz, "Knowledge Management in Academic Libraries," (2001), 35.

109. Richardson, *Knowledge-based Systems*, (1995), p. 297.

110. Ibid., p. 51.

111. Jahoda, Braunagel, *The Librarian and Reference Queries*, pp. 2–4; Grogan, *Practical Reference Work, 2nd ed.*, pp. 50–54; Richardson, *Knowledge-based Systems*, p. 92.

112. Richardson, *Knowledge-based Systems*, (1995), pp. 36, 137.

113. O'Dell, Grayson, "Identifying and Transferring Internal Best Practices," (July 16, 2001).

114. Barth, "KM Horror Stories," (September 14, 2000).

115. Southon, Todd, Seneque, "Knowledge Management in Three Organizations," (2002), 1057.

116. Yvonne Butler, "Knowledge Management—If Only You Knew What You Knew", *Australian Library Journal* **49** (2000, February) (1), p. 40.

117. Cynthia G. Wagner, "The Rise of the Knowledge Manager," *The Futurist* 36, no. 2 (March/April 2002): 14–15; Broadbent, "The Phenomenon of Knowledge Management," 23–26.