Knowledge Management Technology Review

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Introduction

Today, many organizations proclaim that they are knowledge-oriented or learning organizations. In these organizations, stakeholders often use technology to try to enhance their collective capability to capture, transform, organize and distribute information. Purportedly, these technologies enable employees to increase their knowledge and improve timeliness and access to vital information.

What is happening with knowledge management and how does technology help organizations achieve KM-related goals?

Managing effective knowledge management technology requires a systemic view which is achieved by considering organizational imperatives, social dynamics and technological solutions. However, this paper focuses on only one of these three dimensions, which is the technology. In order to achieve a fresh perspective on the dynamics that are currently shaping knowledge management technology, support information was drawn from practitioner and academic literature and personal experience. This paper is divided into four sections.

In the first section, there is information about the organizational context in which knowledge management initiatives originate. Organizational context is defined the unique sets of issues and goals which, ultimately, create the need for knowledge management technology. In addition, this section includes information about roles and associated responsibilities that have emerged for individuals who are skilled at different aspects of managing technology.

In the second section, there is an overview of current knowledge management initiatives. Knowledge management systems are installed for a wide variety of reasons. Here, in particular, there is a focus on common KM initiatives that enhance customer intimacy, product leadership and operational excellence.

The third section contains information about knowledge management technology functions and features. Within the scope of this paper, it is possible to provide descriptions of the nature and complexity of the key functions. However, it is not possible to deliver an exhaustive review of the many systems which currently comprise the marketplace. This marketplace is one in which perpetual convergence of technology features occurs and this makes evaluation and selection difficult to accomplish. Nevertheless, we aim, at least, to support a framework based on a classifying KM technologies into four groups: intermediation, externalization, internalization and cognition. Also included is information about market developments, examples of technologies and possible developments in this area.

Finally, section four offers information about why and how organizations are measuring the value of knowledge management technology. Also included are several appendices which offer greater detail about technology issues.

The Organizational Context of Knowledge Management Technology

The organizational context is all about the unique sets of issues, goals, work processes and staffing which are needed to yield the expected results. This section provides information about the influences which determine how organizations align KM technology.

Aligning Knowledge Management Technology with Organizational Issues and Goals

We can assume that knowledge management initiatives are conceived and launched to address a wide variety of organizational issues or goals. Skyrme states that many (knowledge management) programmes start by focusing on the thrust of better sharing of existing knowledge (e.g., sharing best practices) and the creation and conversion of new knowledge through the processes of innovation. [**1**]

Clarification of the underlying issues and goals is a necessary condition in order to identify which work processes are relevant. So, before considering particular knowledge management initiatives, it is likely that organizational leaders will have selected relevant work processes to change or improve.

Knowledge management practitioners often identify issues and goals in response to questions such as the ones expressed below.

- Consider new supplier relationships. How might these relationships change the company?
- What financial goals have changed? Is it important to keep sufficient cash on hand, raise equity and debt capital, or increase revenues and earnings?
- Why are you trying to forge new (supplier or partner) relationships?
- What obstacles prevent you from retaining and expanding your customer base?
- How strong are your company's brands?
- What are you current goals related to customers? Do you seek to enhance relationships with customers? Are you trying to develop better distribution channels?
- What are your goals for changing relationships with vendor, partners or suppliers?
- Are customers changing? How are today's customers different from past customers? Are there changes in types of customers, characteristics of profitable customers, ways to retain customers, or information about customer issues and needs?

In the context of KM technology, frequently-cited organizational goals include: the need to eliminate work redundancy, cut operational costs, minimize time looking for information, learn new skills and add to their knowledge continuously, deliberately manage information and knowledge, manage and access documents, information about people, programs within and outside the organization, track employee skills and training, track and assist customers and suppliers, capture best practices and lessons learned.

Interestingly, in one organization where several knowledge management technology have been successfully conceived and deployed, management installs technology with the

expectation that it will transform the work; they do not attempt to change the work prior to installation of the technology. [**2**]

Most knowledge management practitioners recognize that a one-size-fits-all technology will not fulfill all organization needs. A term that originated in training and education but can be extrapolated to reflect an emerging perspective towards knowledge management technology is **blended learning**. Blended learning is defined as a method of educating at a distance that uses technology (high-tech, such as television and the Internet or low-tech, such as voice mail or conference calls) combined with traditional (or, stand-up) education or training. [**3**] The idea behind blended learning is that instructional designers review a learning program, chunk it into modules, and determine the best medium to deliver those modules to the learner. [**4**]

Effective guidance for accomplishing blended learning can be found in this 1998 model which represents a process in which the user moves progressively through a series of decision "filters" in an orderly way to arrive at a final decision about which technology to use. [**19**] The five "filters," in order of priority, as adapted to a knowledge management perspective are:

1. **Content** (relevant work processes) must be considered in order to identify the learning requirements for person-to-person interaction and the requirements for visual or graphic aids to learning. The key issue here is what kinds of interactions with the material are required for effective learning.
2. The **Learners** (organizational stakeholders) analysis identifies the homogeneity of the learners' levels of knowledge and learning styles as well as the learners' motivation. Analysis of the learning environment identifies the learners' requirements for synchronous learning and their ability to access technology. The order in which these two first components are dealt with is not rigid. In some situations, decision makers may consider Learners in advance of Content: in others, Content will precede Learners.
3. Consideration of the broad range of **Delivery Formats** (packages and media) will identify a subset which will deliver effective learning given the specified content and learners.
4. The decision maker will then determine if the organization has the human and technological **Resources** (people and KM infrastructure) to support the specified technologies.
5. Finally, the decision maker will conduct a **Cost Analysis** (evaluation of ROI) of the short list of technologies in order to select one that will deliver an effective, affordable course.

So, the value of this perspective – blended learning – is related to the idea that knowledge management technology should address a wide variety of settings and situations including asynchronous and synchronous and virtual and co-located communications.

Staffing Knowledge Management Technology Initiatives

Specialized positions have emerged in response to the need to effectively specify, install, administer and retire knowledge management technology. There are some organizations that actually have professionals with "knowledge management" in the title. In most situations,

knowledge managers were not hired from outside the company, but were internally moved from IT, library science functions, and intra-organizational consulting.

Information technology professionals usually possess some understanding of the organization's basic information technology strategies and how knowledge management technology fit. Librarians offer good ways to organize and catalog information and therefore help with the value-added role of categorizing. Internal consultants usually have a good understanding of business process management, quality control and change management; these disciplines are helpful because they serve as a foundation understanding work dynamics and managing implicit knowledge.

Other roles and positions are certainly possible. An example of a knowledge management job categorization schema is found in Appendix 3.

Today, education credentials do not seem as valuable as practical experience. Higher education and degrees for knowledge managers are not widespread, though there are several initiatives underway to formalize standards and certifications for knowledge management professionals. Organizations such as the Global Knowledge Economics Council [**12**], Knowledge Management Consortium International [**10**] and the Association of Knowledgework [**11**] offer knowledge management certification programs.

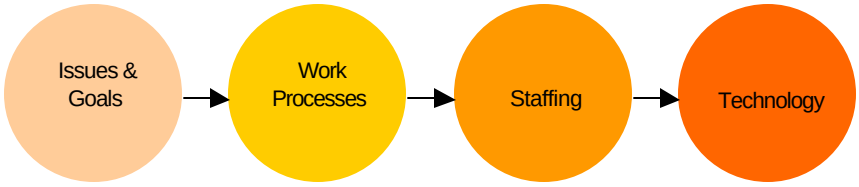
Evaluating Knowledge Management Technology Products

Obviously, the organizational context of knowledge management technology is significantly influenced by the specific technologies that are deployed. Finding a knowledge management technology product to suit one or more particular knowledge management needs is a challenge because many vendors state that they offer knowledge management solutions. However, the actual range of functionality is quite varied. The task is made more complicated by the fact that applications do not include just one discipline, but integrate numerous fields of study.

When evaluating, the common decisions are:

- Which tools are available, for what purpose and at what cost?
- What return on investment (ROI) is achievable and likely?
- What is the impact on the organization which uses KM technology?
- What the potential impact on customers and other stakeholders?

In this section, we identified the context around knowledge management technology. This context is represented by a chain of thinking which starts with articulating issues and ends with selecting technology solutions. Between issues and installed technology are a wide variety of work analyses and personnel requirements.



An Overview of Knowledge Management Technology Initiatives

There are a variety of knowledge management initiatives that ultimately require knowledge management technology. The purpose of this section is to explore the rationales and variables which influence the installation and use of KM technology.

Target Work Processes

An effective way to consider varying types of KM initiatives is in regards to the actual organization functions or work processes that participate. For example, KM technology is usually applied to organizational and inter-organizational processes such as:

- designing products and services
- determining customer needs and wants
- developing strategy
- managing improvement
- managing information
- managing physical resources
- marketing and selling
- measuring customer satisfaction
- producing products and services
- servicing customers
- training employees

A detailed list of target work processes (which expands upon the eleven macro-processes above) is found in Appendix 4.

Managers select the target processes by considering problems and opportunities:

- What particular work is vital for success?
- Focus on which target work processes are consistent with the organization's strategic outlook?
- If not immediately improved, what work could cause the organization to experience significant detrimental consequences?

Obviously, technology implementations are significantly influenced by the expected results and consequences. Skyrme offers a way to sort out differing types of initiatives. He reports that the value of effective knowledge management technology is likely to be seen in one or more of three expected or realized benefits: customer intimacy, product leadership, and operational excellence. [**1**]

When pursuing the goal of Customer Intimacy, these results are expected:

- Increased orders and proposal acceptance from having more knowledgeable sales and marketing people -- by transferring mental models and perspectives that exceptional performers use to all practitioners.

    - This benefit can be realized by focusing on work processes such as: determining customer needs and wants, predicting customer purchasing behavior, and determining weaknesses of product/service offerings.
- Higher customer satisfaction leading to greater customer loyalty, less sales and marketing cost per dollar sold, and greater market penetration by providing better service to customers with individual requirements -- made possible by pooling knowledge among team members and having instant access to expert networks.
    - This benefit is likely to be achieved by focusing on work processes such as: measuring customer satisfaction, translating customer wants and needs into product and/or service requirements, providing after-sales service, and responding to customer inquiries.
- Greater market penetration and profit margins with individualized product specifications and customer service -- achieved by obtaining and acting on in-depth knowledge of product use in customer environments and effects on customer profitability and success.
    - This benefit can be achieved by focusing on work processes such as: determining customer needs and wants, developing new product/service concept and plans, and developing product/service enhancements.

When pursuing the goal of Product Leadership, these results are expected:

- Higher quality products leading to higher value to customers and better market acceptance, with greater profitability and enterprise viability -- resulting from better transfer of knowledge from outside sources and new educational programs that provide wider horizons and general understanding in designers and marketing people.
    - This benefit can be realized through focus on these work processes: designing products and services and more specifically, through translating customer wants and needs into product and/or service requirements and developing and integrate leading technology into product/service concept.
- More innovative and advanced products that open up new market niches with increased sales to increase net income per share -- by fostering personal innovation, increased sharing of knowledge between marketing, manufacturing, and product development, and a new research agenda.
    - More innovating products are likely to result from focusing on work processes like: developing product/service enhancements and eliminating outdated products/services.

When pursuing Operational Excellence, these results are expected:

- Less costly products and services result in higher net profit – resulting from increased benchmarking and greater sharing of best practices between different groups and inside and outside the organization.
    - To produce less costly products and services, focus on these work processes will help: developing benchmarking capabilities and improving processes and systems.
- More timely product deliveries, reduced inventories, less rework, and greater customer satisfaction -- by increasing craftspeople's and foremen's knowledge of their own and adjacent processes.
    - Timely deliveries and other benefits are often the result of focusing these work processes: implementing continuous improvement and reengineering business processes and systems.

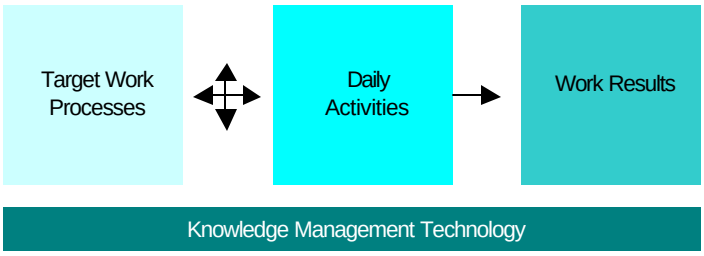
- Greater product consistency leading to reduced operating costs -- from increased knowledge by all employees of the effects of product variations on customer requirements, sales, and enterprise profitability.
    - Product consistency is often achieved by focusing on these work processes: creating commitment for Total Quality Management and managing the TQM life cycle.

Daily Work Activities

Daily work activities that are influenced by knowledge management technology are usually described as broad activities like: learning, instructing, communicating, making decisions, setting goals, designing, researching, solving problems, building relationships, and supervising. [**5**] These actions occur in the context of the work processes cited above. For example, setting goals and solving problems are part of the everyday activities associated with servicing customers and producing products and services.

The results of the work performed with assistance of KM technology are outputs like decisions, information, competent stakeholders, improved relationships, useful reports, analyses, plans, problem statements, project management files and varieties of research. Of course, the results include both artifacts and intangible results.

The following diagram depicts the relationships previously explained. Both the target work processes and the daily work activities are supported by knowledge management technology. Also, the results of the work are delivered via KM technology infrastructure.



Knowledge Management Work Processes

In addition to the target work that is the reason for installing the knowledge management technology, there is an additional set of processes which help to transform the work. These processes are referred to as knowledge management work processes. The KM work processes enable the knowledge management technology to accomplish its aims. The effectiveness of KM work processes strengthens or accelerates the transformation of the target work processes.

Knowledge management work processes can be organized into twelve processes [**5**]:

1. Leading, Visioning, Strategizing - Understanding and adapting to cultural and social influences is vital for the success of KM projects. These KM work processes indicate the types of activities that are usually performed when transitions and change take place.
2. Designing - Design-oriented KM work is focused on the fundamental work that must be established for effective knowledge sharing to occur (regardless of the type of initiative). Knowledge management work processes for design and delivery are all about ways in which knowledge assets can be physically embedded into products or services.
3. Managing Categories of Information – As more and more information is created and acquired, the need for coherent categories and taxonomies becomes more important.
4. Managing Knowledge Assets – Producing, applying and commercializing knowledge is often an essential component of knowledge management work processes.
5. Eliciting – Eliciting is the natural human communications process in which two or more people talk about the procedural and contextual dimensions of work.
6. Training & People Development - If the target work process is related to nurturing people and competencies, there are several KM work processes which help to accelerate and strengthen the effort. Building trust and producing basic explanations for basic knowledge management work processes is vital for most projects.
7. Recognizing and Rewarding – Incentives sharing know-how are essential for effective knowledge management.
8. Communicating - Ultimately, after knowledge sharing activities are in place, they yield artifacts (knowledge assets) that can be further distributed to organizational stakeholders. Prior to distribution, traditional marketing and selling-oriented tasks should be accomplished so that awareness and acceptance are optimized.
9. Managing Information Technology - Organizations usually have legacy systems that influence the ease with which knowledge management technologies are installed and used. One or more of the KM work processes related to information technology are usually performed so that this dimension is adequately addressed.
10. Documenting - Many organizations which undertake knowledge management initiatives have or will also invest in substantial intellectual property protection. These knowledge management work processes help to provide a secure inventory for assessing and valuing intellectual property.
11. Auditing & Evaluating - When new initiatives originate, inevitably, they are sponsored and budgeted. This list of KM work processes includes activities which are often performed when attending to the financial aspects of projects.
12. Managing Facilities - The physical environment in which KM initiatives are installed is sometimes overlooked as a way to achieve organizational objectives. These knowledge management work processes accentuate the need to manage the work setting.

Each process has a set of constituent sub-processes. For example, Leading, Visioning & Strategizing consists of:

1. Leading, Visioning, Strategizing
    1.1. Formulate a knowledge-oriented vision for your project, team, division, or organization.
    1.2. Integrate knowledge management with organizational strategy.
    1.3. Devise organizational policies for knowledge management.
    1.4. Assess organizational readiness for knowledge management.
    1.5. Assess cultural issues and extent of change management.

1.6. Develop the business case for knowledge management.
1.7. Establish a knowledge-management function.
1.8. Create a budget for a knowledge management initiative.
1.9. Create policies for protecting knowledge assets (patents, trademarks, licenses, copyrights, trade secrets, know-how).

Some names of the knowledge management work processes are similar to the work process (which are the target of technology). However, all of sub-processes in this list are only related to the transforming knowledge management work. A detailed list of macro and sub-knowledge management work processes is found in Appendix 5.

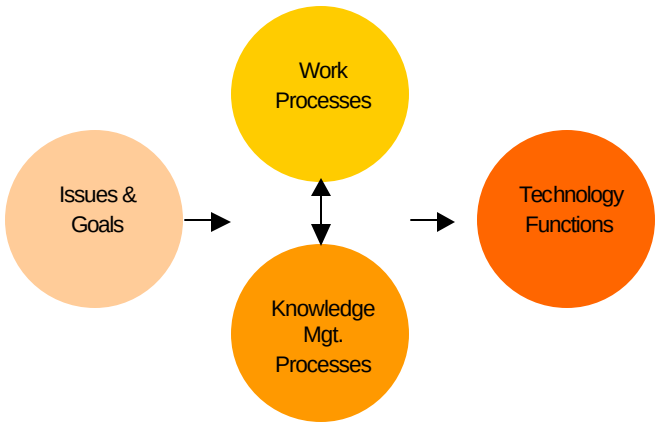
Selecting a knowledge management initiative for a particular organization is always unique. However, the American Productivity Quality Council has documented a Road Map that lays out the characteristics, requirements, and action steps of each stage of KM implementation

1. Get Started
2. Develop a Strategy
3. Design and Launch a KM Initiative
4. Expand and Support
5. Institutionalize Knowledge Management

In particular, prior to Stage Three, the organization: has designed a pilot and implementation strategies, launched communities of practice, an interactive KM Intranet site, or some other pilot initiative. The organization has enlisted and trained pilot facilitators and leaders, has established pilot measures and indicators and developed a system for tracking and reporting results, and has created strategies for learning from your KM initiatives.

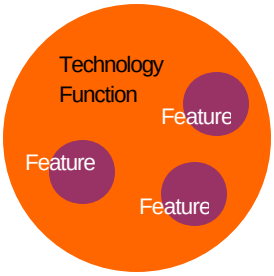
During Stage Three, the organization will fund the pilots, develop methodologies that can be replicated, and capture lessons learned. [**6**]

The purpose of this section was to depict the interrelationships between work processes, knowledge management work processes and knowledge management technology functions. Organizational issues and goals drive the selection of work (processes) and associated knowledge management work processes which drive selection and use of technology functions.



The next section of this report will address knowledge management technology functions and features.

Functions and Features of Knowledge Management Technology



Varieties of information technology and knowledge management technology are expressed in terms of functions and features. Functions are defined as the operations that a particular solution will accomplish. Features are notable properties or behaviors of a system; features are associated with functions.

Knowledge management systems functions differ from other information technology solutions in that they are less focused on data and managing transactions and more focused on information and information sharing. Over the past five years, the actual number of differing functions has changed and grown significantly.

In this section, we have adopted Delphi Group's categorization approach for characterizing knowledge management technology. Knowledge management technology can be perceived in regards to four major dimensions: intermediation, externalization, internalization and cognition. [7]

- To **externalize** means to make capable of being outwardly perceived or conceived. KM technology that enhances externalization helps to make some idea or action more apparent. Externalization provides a means to capture and organize for review explicit or implicit knowledge.

- To **internalize** means to give a subjective character to a value or an idea. To internalize means to incorporate within the self. KM technology for internalization helps someone incorporate ideas and actions through learning (including simple and complex discovery) or socializing.

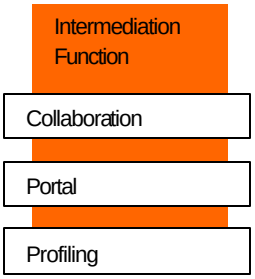
- To **intermediate** means to serve as a go between or middle place or stage. An intermediary KM technology helps to bring, effect, or communicate with someone or something else. At the high end, intermediation also brokers or teams up the knowledge seeker with the knowledge provider.

- **Cognition** is the act of knowing which includes awareness and judgment. Technology that aids cognition helps its users to gain understanding or get familiar with ideas and actions. Cognition features can also lead to automated decision-making.

Intermediation Functions

Knowledge management technologies which facilitate intermediation are especially valuable for organizations that are highly distributed geographically and therefore less likely to encounter face-to-face or synchronous communication in normal course of interaction among knowledge workers. [7]

In particular, three specific KM technologies help to accomplish intermediation functions: Collaboration, Portals, and Profiling.



Collaboration Features

In the context of knowledge management technology, to collaborate means to work virtually with others in some intellectual endeavor.

Collaborative functions are also known as groupware and support online discussions and workflow. With collaborative technology, the goal is to use the technology to identify others with similar interests or expertise and collaborate in a secure accessible, environment. The first task is to identify and access information particular to their needs. Next, individuals collectively create a dedicated workspace to manage, control and share content. Finally, collaborators communicate synchronously and asynchronously.

Below are common features found in collaborative solutions.

Communicating	▪ Discuss (asynchronously) via messaging feature. ▪ Participate in real-time chat. ▪ Receive paging (instant message). ▪ Review the presence indicator.
Integrating Content Managing a Team Workspace	▪ Connect to enterprise repositories. ▪ Integrate Email. ▪ Organize content. ▪ Carry out multi-threaded discussion groups. ▪ Carry out multi-topic discussion groups. ▪ Conduct a poll. ▪ Create a new virtual workspace for a team or entire organization. ▪ Create roles for a new workspace. ▪ Invite and add new participants (control access to the workspace). ▪ Manage role-based access. ▪ Organize content in a hierarchical structure. ▪ Reorganize and customize the workspace. ▪ View content related to a project.
Managing Alerts	▪ Automatically change a notification. ▪ Automatically send email about notification of changes to the workspace. ▪ Use the “unread” indication (individual items on a per-user basis). ▪ Visually indicate changes to the workspace.
Managing Contributions	▪ Establish a faux currency for transactions. ▪ Rate a contribution ▪ Determine user’s aggregate rating. ▪ Reward a contributor
Publishing	▪ Publish a form.

Searching	▪ Publish to HTML. ▪ Conduct a full text search. Search across multiple projects. ▪ Search by author. ▪ Search by content. ▪ Search by date. ▪ Search by keyword. ▪ Search by unread. ▪ Search member profiles. ▪ Search object metadata.
Working Offline	▪ Edit content offline. ▪ Upload content (file) after edit.

Because collaborative technology has a strong emphasis on communications, the following variables can be used to help clarify the differences among features. In regards to time independence, ask – "Is synchronous (real-time) communications necessary for our collaboration?" In regards to communications structure, ask – "Is it important to carry out structured or unstructured communications?" Structured communications impose form and format. Below are examples of collaborative features and the nature of communications that they support.

Collaborative Feature	**Time Independence**	**Communications Structure**
Computer Conferencing	Synchronous	Unstructured
Shared whiteboards	Synchronous	Unstructured
Follow-me browsing	Synchronous	Structured
Real-time Chat	Synchronous	Unstructured
Group calendars	Asynchronous	Structured
Threaded discussions	Asynchronous	Unstructured
Email	Asynchronous	Unstructured
Electronic meeting systems	Synchronous	Structured

Portal Features

Another intermediation function fulfilled by knowledge management technology is portals. A portal serves as a go between or middle place. The goal of a portal is to deliver an all-encompassing web page which provides single-point access to vital work applications and voluminous amounts of dynamic information. Typically, portal users can individualize the layout and content of available information resources.

The ideal habitat for the application of corporate portals is at the intersection of the front and back office. This "middle office" operations space is best defined by the role and function of knowledge workers who constitute the linkage mechanism(s) between front office and back office information systems and processes. The great attraction to the idea of portals is based on their ability to create a "single point of access," which integrates, within one interface the unstructured content of knowledge work with information from the wide variety of ERP, document and CRM systems. Since every individual's professional (and personal) information needs are different, the portal takes on the unprecedented role of delivering a personalized, function-centered desktop. [**7**]

Common features found in portals are cited below.

Integrating Content	▪ Achieve access & single sign on for internal applications, databases and legacy applications. ▪ Achieve access & single sign on for web sites. ▪ Determine accessible formats (such as HTML, MS Office files, Lotus Notes. ▪ Retrieve image files, SQL databases, and external feeds).
Managing the User Interface	Customize the user interface. ▪ Personalize the content. ▪ Personalize the layout. ▪ Set or alter a user's role.
Organizing Information	▪ Customize a taxonomy. ▪ Manage private folders.
Personalizing	▪ Alter layout of content. ▪ Profile users via click stream, published items, or user-define variables. ▪ Set profiles. ▪ Use alerts. ▪ Use document tracking of what has been changed or what is new. ▪ Use event-based notification.
Publishing	▪ Publish to groups of users. ▪ Publish to one or more channels. ▪ Publish to other users.
Searching	▪ Perform a Natural Language Search. ▪ Search by content. ▪ Search by keyword. ▪ Search through structured data (such as, databases, legacy applications). ▪ Search through unstructured data (i.e. Word, Acrobat, Internet sites, Intranet sites). ▪ Use an automatic taxonomy categorization.
Sharing Documents	▪ Share a document.
Subscribing	"Pull" content. ▪ Receive ("push") content.

Profiling Features

In the context of knowledge management technology, to profile means to concisely represent biographic information about organizational stakeholders.

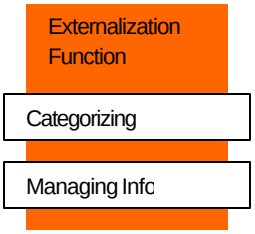
Profiling systems can create online dossiers of individuals and track who they are, what projects they have worked on, search habits, and what documents they have authored, edited, and read. Profiling serves as the foundation for expertise directories which are also known as people finder systems. [7]

Common profiling features are cited below.

Searching for expertise	▪ Access a database of all employees and their addresses and contact information
Managing a profile	▪ Contribute a personal profile. ▪ Change personal profile based on changes in role or work responsibilities. ▪ Express preferences. ▪ Find an individual who possesses a particular interest of skill. ▪ Recruit a team member.

Externalization Functions

To externalize means to make something capable of being outwardly perceived or conceived. KM technology that enhances externalization helps to make some idea or action more apparent. Externalization provides a means to capture and organize for review explicit or implicit knowledge.



Technologies for externalization are like intelligent inventory systems that catalog knowledge both as it is needed and as it is encountered (i.e. entered) are required. [**7**]

Categorizing Features

To categorize means to arrange target information or collections of information into classes. The classes are groups which share common attributes.

Taxonomies have proved to be a popular way in which to build a domain model to help users to search and navigate. As on-line tools become central to individuals' work, they usually want to see information within a structure that reflects their worldview. This results in more and more taxonomies. Therefore, there will likely be an increasing focus on the need to map the contents of one taxonomy to another taxonomy.

Common categorization features are cited below.

Building Taxonomies	▪ Automatically generate a taxonomy. ▪ Build a taxonomy. ▪ Define a collection. ▪ Enter a list of core concepts. ▪ Rebuild a taxonomy automatically. ▪ Utililize the pattern matching algorithms. ▪ Map content between taxonomies

Information Management Features

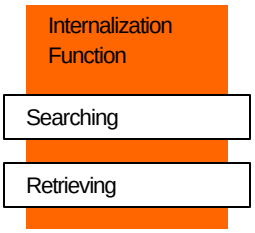
To manage information or content means to successfully handle communications about know-how, descriptions and signals. An information repository may also be known as a document database, electronic document management system (EDMS), corporate memory or organizational memory. Below are examples of information repository technology features.

Administering the repository	▪ Facilitate authoring, compiling and controlling of documents ▪ Support version control. ▪ Define access permissions. ▪ Facilitate content repurposing. ▪ Submit unstructured information (documents) to a repository. ▪ Submit structured (forms-based) information.
Administrating	▪ Access & single sign on for web sites. ▪ Access & single sign on for internal applications, databases and legacy applications.

	▪ Bulk load files. ▪ Conduct session monitoring. ▪ Create and manage templates. ▪ Create indexes. ▪ Establish a business rules repository. ▪ Establish roles for authoring or read-only. ▪ Implement a calendar.
Managing Documents and Folders	▪ Check-in or check-out a document or folder. ▪ Lock a document or folder. ▪ Notify users of changes (with alerts or reminders): event based notification, document tracking of what is new, document tracking of what has been changed. ▪ Replicate a document or folder.
Managing Index	▪ Perform full-text indexing. ▪ Perform fielded indexing. ▪ Perform schedulable indexing.
Managing Links	▪ Create a hypertext link. ▪ Delete a link. ▪ Attach a links to a document. ▪ Link to URLs. ▪ Link to other documents in repository.
Managing the Life Cycle	▪ Establish the stages of the cycle: Review, Approve, Reject, Release, Archive. ▪ Establish user-defined access. ▪ Review the audit trail (of authors, dates, and times).

Internalization Functions

To internalize means to give a subjective character to a value or an idea. KM technology for internalization helps someone incorporate ideas and actions through learning (including simple and complex discovery) or socializing.



Internalization technology is perhaps the oldest among knowledge management technology, with its roots in search and retrieval engines.

Searching and Retrieving Features

To search and retrieve means to expend resources or effort to find or discover and then call to mind the results of finding or discovering. Usually, the found information is recovered from some source of storage.

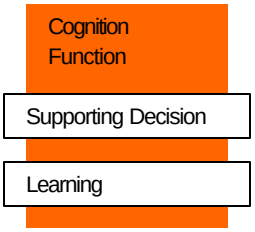
Search technology accesses information that has been indexed, tagged, and categorized from inputs such as web pages, file servers, intranet sites, and email messages. Some search technologies will cross reference and link information. This way, users do not need to know the location. Below are common features found in search technology.

Querying	▪ Automatically generate levels of a hierarchical index. ▪ Automatically update an index. ▪ Create a directory of information resources. ▪ Create a directory of thesaurus-like links. ▪ Create a map view of content.

	▪ Create a multi-level directory. ▪ Evoke the external web crawler. ▪ Evoke the internal crawler. ▪ Highlight concepts within document. ▪ Integrate search function with portal. ▪ Perform a Boolean search. ▪ Perform a concept search. ▪ Perform a full-text search. ▪ Perform a keyword search. ▪ Perform a natural language search. ▪ Perform a proper name search. ▪ Perform a proximity search. ▪ Search unstructured data (such as Word files, Acrobat files, Internet sites and Intranet sites). ▪ Search structured data (such as databases and legacy applications). ▪ Store search results. ▪ Visually represent the results of a search.

Cognition Functions

Cognition is the act of knowing which includes awareness and judgment. Technology that aids cognition helps its users to gain understanding or get familiar with ideas and actions. Cognition features can also lead to automated decision-making.



The role of cognition tools is to manage the links and information needed to follow certain rules in order to convey knowledge. Most knowledge management cognition tools today are vertically focused. Decision support trees and case management and decision support tools are more easily created when focused on a finite problem or need, such as learning applications, call centers, and sales force automation. [7]

Decision-support Features

To support decisions means to determine a solution or choice that serves to end uncertainty.

Because decision-support technology has a strong emphasis on communications, the following variables can be used to help clarify the differences among features. In regards to time independence, ask – "Is synchronous (real-time) communications necessary for our collaboration?" In regards to communications structure, ask – "Is it important to carry out structured or unstructured communications?" Structured communications impose form and format.

Below are examples of decision-support features and the nature of communications that they support.

Decision Support Feature	Time Independence	Communications Structure
Groupware	Asynchronous	Unstructured
Collaborative writing systems	Asynchronous	Structured
Group decision support systems	Synchronous	Structured

Learning Features

To learn means to gain know-how or understanding of by self-study, guidance, or experience. A substantial market for e-learning (learning management systems, performance tracking and courseware) has arisen in response to the need to improve the effectiveness and efficiency of employee education. With learning technology, users have the ability to receive instruction and other learning-oriented content virtually, through the use of web-based audio, video and print content.

Because learning technology has a strong emphasis on communications, the following variables can be used to help clarify the differences among features. In regards to time independence, ask – "Is synchronous (real-time) communications necessary for our collaboration?" In regards to communications structure, ask – "Is it important to carry out structured or unstructured communications?" Structured communications impose form and format.

Below are examples of learning features and the nature of communications that they support.

Learning Feature	Time Independence	Communications Structure
Computer-Based Training & Electronic Performance Support Systems	Synchronous	Structured
Mailing lists	Asynchronous	Structured
Multimedia	Synchronous	Structured
Newsgroups	Asynchronous	Structured
Records of team activities	Asynchronous	Structured
Self-directed learning objects	Synchronous	Structured
Shared files	Asynchronous	Structured
Simulation	Synchronous	
Video Broadcast	Synchronous	Structured
Video Conference	Synchronous	Structured
Videos	Asynchronous	Structured
Web lectures	Synchronous	Structured
Web pages	Asynchronous	Structured

Future Functions

In the future, at least two prominent knowledge management technology functions are likely to emerge: taxonomy building and user modeling. With taxonomy building, the goal is to create maps between concepts so that stakeholders can organize and locate information more effectively. Delphi Group believes taxonomy software is an enabling technology. The long-term evolution of the market for taxonomy will be its integration into applications such as Enterprise Portals and Content Management. The first integration of taxonomy technology will be with search and retrieval software. [**8**] The integration of user modeling features offers the promise of adapting other KM functions and features to the particular interests, needs and preferences of individual users.

The Value of Knowledge Management Technology

How will you know if the KM technology actually helped you accomplish the goal? Here are examples of common practitioner-oriented questions for assessing value.

- What benefits, financial and otherwise, does knowledge management provide?
- Who is the intended recipient of the benefits?
- What has to be done to obtain the benefits?
- When will the benefits be realized?
- What is the cost of realizing the expected results?
- What areas are impacted?
- What is the mission-criticality or relative importance of the impacted area(s)? Consider risks to be avoided or benefits to be gained.
- What is the knowledge management's contribution to the success of the enterprise?
- How do you measure the impact of knowledge management technology investments?
- One of the key drivers of success is the ability to rapidly respond to new challenges or to take advantage of new opportunities. How would you evaluate your company's ability to move quickly?
- Which work processes do you actively measure?

CIO magazine states that some benefits of KM correlate directly to bottom-line savings, while others are more difficult to quantify. In today's information-driven economy, companies uncover the most opportunities and ultimately derive the most value from intellectual rather than physical assets. To get the most value from a company's intellectual assets, KM practitioners maintain that knowledge must be shared and serve as the foundation for collaboration. Yet better collaboration is not an end in itself; without an overarching business context, KM is meaningless at best and harmful at worst. Consequently, an effective KM program should help a company do one or more of the following:

- Foster innovation by encouraging the free flow of ideas
- Improve customer service by streamlining response time
- Boost revenues by getting products and services to market faster
- Enhance employee retention rates by recognizing the value of employees' knowledge and rewarding them for it
- Streamline operations and reduce costs by eliminating redundant or unnecessary processes [**9**]

Determining the Costs of KM Technology

In order to estimate value, it is essential to determine the costs. There is a trend towards new forms of accounting for KM technology. In the past, cost analyses consisted of gathering the direct costs associated with a particular set of information and communication technologies. Direct costs were (and typically are) the most familiar and easily comprehended costs. Direct costs are the costs that can be directly allocated to the activity in question. KM technology managers have not been so effective at recognizing the other components that make up the

total cost of ownership (TCO). TCO estimates suggest that other costs may make up as much as 60-70% of total costs.

Today, new forms of cost analyses call for managers to think in new ways (activities, resources, and drivers) and learn how to optimise activities in the value chain instead of functions. Managers utilize and share accounting information to improve the use of resources and overall organisational performance. For example, within higher education institutions, leaders are encouraged to not view cost management as an accounting process but as a strategic tool that provides them with information and feedback which helps them to set goals and track progress towards their attainment in an environment of intensifying competition. [**23**]

In the past, traditional cost management systems allocated service overhead costs to services or departments primarily to distribute the overhead for financial reporting purposes. Costs are attributed by a one-step process (costs per services or customers) using simplistic allocation methods often producing inaccurate and misleading information. In many service institutions the distribution of overhead was seen to be unimportant or irrelevant.

Today, there is more widespread awareness that the costs of a product or service should be just one of a number of factors to influence a purchase decision. [**26**] A similar perspective is exemplified by an approach called rapid economic justification. REJ looks at the entire picture from start to finish - including goals, costs, benefits, risks and solutions. By piecing them together and creating a framework, a manager is able to produce a quantifiable answer when asked, "What's the bottom line?" The REJ process examines the immediate and hidden expenses of projects to determine total cost of ownership (TCO). The TCO model considers not only anticipated expenses associated with IT projects, but unexpected expenses as well. To properly identify these metrics, organizations must analyze budgeted (direct) costs (hardware and software, management personnel, support personnel, development, and communications fees) and unbudgeted (indirect) costs (participant learning curves, downtime, inconvenience, adoption rate, and volume of transactions).

Example: The Costs of Learning- oriented KM Technology

A good example of a KM technology where costs have been effectively analysed is learning-oriented function. When KM technology is focused on education and instruction, the costs of any system are driven by a combination of the following factors, all of which are susceptible to management control:

- Course populations
- The number of courses offered
- The lengths of course lifetimes
- The media and technologies chosen
- The extent to which cost-inducing actions, for example, the use copyrighted materials, are avoided
- The extent to which costs are placed on students, either as tuition, or by moving the system boundaries so that activities the institution might once have paid for are now paid for by students (e.g. access to tutorial and library services)
- The extent to which the institution employs people on contracts for service (i.e. salaried posts) to develop courses and teach students, rather than on contracts of

service (i.e. hired as casual labor, to be paid by the manuscript/script/tutorial hour/test marked, etc.)
- The extent to which the institution adopts working practices that reduce the costs of labor by, for example, designing courses to be wrapped-around existing textbooks rather than developing new materials, and using author-editor models of course design, rather than big course team models
- The use of technology to increase the student load per academic or administrator
- Increases in the teaching load of academic staff at the expense of other functions – for example, research and public service, and …
- 'Labor for labor' substitution – the replacement of expensive academic labor by student and adjunct labor, in order to reduce staff costs. [**28**]

Thus the institutional costs of a fully developed e-education systems would include:
- Developing e-materials
- Teaching (and assessing) participants online
- Accessing the web site
- Administering participants online
- Providing the infrastructure and support within which e-education can operate
- Planning and managing e-education at the macro-level.

KM Systems vendors have also recognized the importance of helping prospects and customers determine return on investment. For example, Docent offers guidance for "Calculating the Return On Your eLearning Investment" [**37**] When developing the ROI estimate, the analysis should consider the following four categories of potential benefits:
- Hard cost savings vs. alternative solutions
- Hard revenue impacts vs. alternative solutions
- Soft competitive benefits vs. alternatives
- Soft benefits to individuals vs. alternatives

Hard cost savings are savings that are typically quantifiable in financial value terms and easily estimated or measured. The following are examples of hard cost savings that should be considered when rolling up the total hard cost savings used in ROI calculations:
1. Travel (airfare, hotels, meals, etc.) A typical scenario: The alternative solution to Docent is a traditional instructor-lead training (ILT) intervention where all personnel travel to one central location for training. The hard travel savings are easy to calculate. Take the sum of airfare, hotel, meals, car rental, etc. and multiply by the headcount number. In many cases, this alone yields a 400% ROI.
2. Facilities
3. Instructor fees
4. Printing, Distribution and storage costs
5. Re-training for growth and turnover, refresher courses, content updates, etc.
6. Reduction of customer support costs (call center, customer education, etc.). To calculate the resulting cost savings, one starts with the average cost per minute for support calls. This data is normally readily available from the VP of Customer Support (total expense of call center divided by the number of customer calls per year divided by the average number of minutes per call).

Hard revenue impact is the total revenue value of the solution that is often possible to estimate or measure. When rolling up hard revenue impact, consider the following factors:
1. Lost revenue (opportunity cost) of not having adequately trained sales personnel.

2. Increased productive time on the job (more revenue producing days per sales rep or other customer facing personnel). Note: One can easily determine the revenue value of a sales rep day by dividing total annual revenue by the number of selling days by the number of sales reps.
3. Shorter time to product deployment by shrinking training ramp which expands the front end of a product life cycle resulting in increased revenue
4. Increased revenue by increasing the sales effectiveness of selling partners
5. Increased revenue opportunities by delivering for-fee training and/or certification to customers, partners, and suppliers and ability to deliver more revenue generating course to more customers

Measuring Performance of KM Technology

What return on investment (ROI) is achievable and likely with KM technology? Although it is now commonly understood that the acquisition of knowledge is central to the competitive advantage of individuals and organizations in today's economy, the question of how much to invest has long confounded business executives and managers alike. [**30**] Eventually, leaders must decide "how much do we invest in KM systems?" This decision is likely to be influenced by measures of expected or actual return on investment.

Performance measures for knowledge management technology are vital for helping organizations state the value proposition for initiatives and providing feedback on the value and effectiveness of the investments.

Typical KM technology measures (which can be applied regardless of the type of KM technology) are:

- Measure the statistics from the KM system. How many times has the web site been accessed? How many times have Lessons Learned or Best Practices files been downloaded?
- Measure the activity of a Community of Practice. How many members are in the community, and how often do they interact? How long has it been since the last contribution to a shared repository or threaded discussion?
- How easy is it for people to find the information they want? Conduct a survey and test the site yourself. How many responses are typically generated from a search? If this number is too high (greater than approximately 50), then people may be giving up the search and not making use of the knowledge assets. Are the responses what the user wants to see? Is the site easy to navigate with an organizational structure consistent with the way they do work and think about the information? What is the system latency, i.e. the wait time between a user requesting something and when the system delivers it?
- Measure how frequently the knowledge assets are updated. Are the Best Practices out-of-date and superseded by new versions? Are the Point of Contacts no longer working on the project? Is there a listed update time that has been exceeded? Are a large number of links to experts no longer valid? [**13**]

In regards to particular knowledge management technology, here are examples of technology-specific sets of measures:

Portal Technology

- Searching precision and recall
- Usage of personalization features
- Frequency of general search versus use of predefined links
- Latency (determination of how long data or information remains dormant and not accessed by users of the system)
- Dwell time (the amount of time a user spends viewing data)
- Number of users
- Number of users with the portal as their home page
- Printed communications cost (reduced costs for printed newsletters)
- Time spent gathering information
- Reduced time to find relevant information
- Reduced training time or learning curve

Learning Technology

- Number of courses taken/user
- Training costs
- Savings and/or improvement in organizational quality and efficiency
- Improved employee satisfaction
- Reduced cost of training

Profiling

- Number of contributions
- Number of site accesses
- Frequency of update
- Frequency of use
- Contribution/update rate over time
- Navigation path analysis
- Time to find relevant expert
- Number of Help Desk calls
- Time to solve problems
- Number of problems solved
- Savings and/or improvement in organizational quality and efficiency

Collaborative Technology

- Latency during collaborative process
- Number of users
- Number of artifacts produced
- Number of projects collaborated on
- Time lost due to project delays
- Number of new products developed
- Average learning curve per employee
- Proposal response times
- Proposal "win" rates
- Reduced cost of product development
- Reduction in number of days of program delays
- Reduced learning curve for new employees [**19**]

Some argue that the absence or presence of technology, itself, is a good indicator if both technology and technology use are taken into account. The GKEC states, technology is a strong indicator because it is not only a cause of economic growth (technology is used in the construction of larger human and physical systems that are capable of generating economic value.), but it is also a result of economic growth. In societies with higher levels of income, individuals employ technology to conserve the increasingly costly human inputs of their own and others' time. They also use technology to forge links between the growing numbers of information resources and to produce innovations in applications aimed at productivity, education, or entertainment. [**24**]

There have been numerous studies which investigate the similarities, differences, and costs associated with KM systems. In particular, studies associated with technologies for distance learning have shown that the use of technology-based instruction delivers these benefits:

- reduces cost of instruction by 30—60%
- reduces time of instruction by 20—40%
- increases effectiveness of instruction by 30%
- increases student knowledge and performance by 10—30%
- improves organization efficiency and productivity [**22**]

Similar statements of justification have been made for other forms of knowledge management technology.

When trying to calculate ROI, evaluations can become more complex. For example, the aims and approach to evaluating a learning technology resource will vary widely according to which of the four major types of resource you are evaluating. For example, in regards to learning-oriented knowledge management technology:

1. Tutorials, simulations or (self-)assessment exercises that involve the student in interaction with the computer. These generally offer complete learning experiences which do not necessarily require any tutor intervention while being used by the student. Key attributes of such a resource are how accurate and unambiguous the content is and how easy it is to navigate for the student. Much can be learned for evaluation purposes by observing how students go about using the resource.
2. Technologies that enable two-way communication, such as email or videoconferencing. These in themselves are not learning technologies but become so when they are used for teaching and learning. These technologies are usually purchased "off the shelf" and so can only be influenced to a limited extent by the user. Their success however can be determined to a large extent by how they are used. Evaluation will therefore focus on whether the product is suitable for the purpose, and on how effectively it has been used.
3. Archives of reference materials (normally created for an educational purpose) stored and distributed through technological means. An example might be a database of digital images available over the World Wide Web, or an on-line Journal. Evaluations of these resources are likely to emphasize the quality of the resources, ease of access and the extent to which they match the users' needs.
4. Tools for authoring resources of type 1. By definition evaluations of this type of resource do not need to involve the end users of the resources created with them, but will concentrate on how easy the tool is for authors to use and what resources it enables them to create. [**28**]

The Market for Knowledge Management Technology

The market for knowledge management technology is expressed by industry watchers as "knowledge management services markets" and "knowledge management software market." Several years ago, the market research firm IDC said that the worldwide KM services industry will grow 41 percent per year between 2000 and 2005, rising from US$2.3 billion to US$12.7 billion. [**14**] According to the IDC reports, knowledge management is picking up momentum and getting ready to leave the early adopter stage behind. The reports also include research suggesting that technology is no longer the sole force driving interest in KM programs. The desire to meet business goals has also become a factor in decisions to implement KM projects. According to IDC, the KM services market will grow to $8 billion by 2003, up from $1.3 billion in 1999. [**15**] Today, as reported by Business 2.0 magazine, IDC estimates that knowledge management software and services will be a $6 billion industry in 2002. [**16**]

In order to get a better view of the knowledge management technology markets, the following sections provide examples of the four major types of technologies – intermediation, externalization, internalization and cognition.

Examples of Intermediation Technology

Examples: Collaborating

eRoom
http://www.eroom.com/
Vendor Statement: eRoom Technology was founded to help organizations across multiple industries build a better workplace - one where the work, the tools and the workplace come together; one that provides business agility; and one that enables people to get more work done while creating a better balance between work and life.

IntraSpect
http://www.intraspect.com/
Vendor Statement: Intraspect's web-based workspaces combine the best of collaboration, knowledge management and document management technologies into a single solution for enterprise collaboration. Intraspect solutions integrate seamlessly with existing tools - email, portals, and line of business applications - enabling employees, customers, suppliers and partners to get work done faster, smarter...every day.

Livelink
http://www.opentext.com/
Vendor Statement: Livelink® is a highly scalable collaborative commerce application that delivers Web-based intranet, extranet and e-business solutions. Livelink removes boundaries and connects you to what matters most. People.

Examples: Portals

Epicentric
http://www.epicentric.com/
Vendor Statement: Epicentric Foundation Server is the most scalable, cross-platform portal application in the industry allowing organizations to build and deliver Web services across diverse business communities such as employees, partners, and customers. Whether you're seeking to solve simple, departmental information and collaboration problems or complex customer and partner management problems, Epicentric Foundation Server 4.0 is the solution.

Plumtree
http://www.plumtree.com/
Vendor Statement: The Web is the way that people will access electronic resources across the enterprise. Using infrastructure based on new Internet standards, a corporate portal will bring together these resources into an experience that's simple enough for everyone to use, anywhere. With over 300 customers and six million licensed users, Plumtree's portal software is the most scalable, widely deployed portal solution on the market.

Examples: Profiling

Organik
http://www.sopheon.com/
Vendor Statement: Organik for the Enterprise can transform your company into a successful, knowledge-sharing enterprise. With Organik you create online knowledge communities focused on products, services, procedures, ideas - communities your employees delve into naturally, by asking questions. With a click of a button, they'll get relevant answers retrieved from a continually expanding knowledge base. Or they'll be connected with the people most likely to have them, people selected automatically by Organik's patented profiling technology.

AskMe
http://www.askmecorp.com
Vendor Statement: AskMe builds software that enables Global 2000 companies to create and manage Employee Knowledge Networks. Employee Knowledge Networks deliver employee expertise, directly to other employees blocked on critical tasks, exactly when they need it most.

Examples of Externalization Technology

Examples: Categorizing

SageWare
http://www.sageware.com/
Vendor Statement: In order to truly leverage digital content, an organization must establish a taxonomy, or a way to organize the text-based information available to the user community.

Sageware has been developing taxonomies for years and provides customers with Taxonomy Services or can simply use an existing taxonomy to develop the categories needed by the Content Tagger.

Examples: Managing Information

Documentum
http://www.documentum.com/
Vendor Statement: Documentum provides enterprise content management software solutions that allow 1,400 of the largest businesses in the world to intelligently create and manage all types of content — documents, Web pages, XML files, and rich media — using one common content platform and repository.

Examples of Internalization Technology

Examples: Searching and Retrieving

Autonomy
http://www.autonomy.com/autonomy_v3/
Vendor Statement: Built on our unique pattern-recognition technology, Autonomy Server™ is the core engine that provides a fully-automated and precise means of retrieving information. It allows content to be searched in any language and any format, wherever it is stored, and presented with hyperlinks to similar information, automatically and in real-time.

Verity
http://www.verity.com/
Vendor Statement: Verity is the leader in business portal infrastructure that connects people with information and matches customers with products. In the enterprise, Verity users spend less time looking for information and more time acting on it. In e-commerce, we turn browsers into buyers that keep coming back for more. And between businesses, we enable transactions online - anywhere and on any scale.

Examples of Cognition Technology

Examples: Learning

DigitalThink
http://digitalthink.com/
Vendor Statement: When you choose DigitalThink, you get the best e-learning products and services offered on the market today. As leaders in e-learning, we are committed to delivering end-to-end, results-oriented solutions that produce business results and also to creating an engaging, instructionally sound, user-oriented learning experience.

Docent
http://www.docent.com/

Vendor Statement: The Docent Enterprise eLearning platform - Whether you need to dramatically increase the knowledge and skill level of your employees, business partners, or customers, or to successfully bring your education and training business to the web, Docent™, Inc. can help. Docent Enterprise — our award-winning software platform for eLearning and knowledge exchange — helps unleash the power of the Internet to deliver a compelling and measurable bottom-line impact.

Examples: Supporting Decisions

GroupSystems
http://www.groupsystems.com/default.htm
Vendor Statement: GroupSystems software offers a unique integration of group dynamics and goal attainment that allows organizations to generate ideas, organize information, narrow in on key issues, prioritize alternatives, build consensus and ready themselves for action.

Hummingbird
http://www.hummingbird.com/
Vendor Statement: Hummingbird specializes in the development of decision-enabling web-based work environments. Hummingbird's enterprise software solutions provide access to business critical information, structured and unstructured data.

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Appendix 2: List of Knowledge Management Technology Vendors

There is a huge variety of KM technology products. Variety is seen in functionality as well as practical capabilities like software developer's kits, administration interface, managing metadata, search, gateways to legacy systems and ease of integration. Below is a list of 95 "KM System Vendors" that are cited in one or more of three buyer's guides.

Brint.com > Reference > Knowledge Management > Software and Tools

KMWorld Buyers' Guide

Open Directory Project - Reference: Knowledge Management: Software and Tools

80-20 Software
ActionPoint, Inc.
Advanced Visual Systems
American Management Systems (AMS)
AskMe Corporation
Assistum
ATS (Advanced Technology Systems)
Banter
BCI Knowledge Group, Inc.
Bell & Howell Scanners
Brain Ranger
Cadenza, Inc.
Canon U.S.A.
CEYONIQ, Inc.
Citrix Systems, Inc.
ClearForest
Comintell Inc
Comshare, Inc.
ComSquared Systems
Convera.com
CSTech, Inc.
Data Dimensions
DCA Software
Disc, Inc.
Eclipsys
eiStream
Elite Information Systems, Inc.
ENCompass
Entopia
Factiva
FileNET Corporation
FolioOne - Online Knowledge Management
FORMTEK
GMB Records and Information Solutions
Go Albert, Inc.
Hewlett-Packard
Hummingbird Ltd.
Hyland Software, Inc.
Hyperwave
IBM Corporation
Identitech
iManage
IMR Alchemy
InfoImage
Insight
InSystems
Intraspect Software, Inc.
ISYS
IT Factory, Inc.
Kanisa, Inc.
KGain
Knowledge Management Software Inc.
KnowledgeMap
Kodak Document Imaging
Kofax Image Products
LexiQuest, Inc.
LTG Systems
Maxim Group
MAYA Viz
Meta Software Company
Mongoose Technology, Inc.
Net Perceptions for Knowledge Management
Noetix Corporation
NovuWeb, Inc
Ontopia
Open Text Corporation
Orbital Software
Panasonic Digital Imaging Solutions
Participate Systems, Inc.
Ptech, Inc.
Quest Software
Quiver, Inc.
Retain International
Selectica, Inc.
Semio Corporation
SER Solutions, Inc.
Silent One
Soffront Knowledge Management
Softheon, Inc.
Sopheon-Teltech
Stratify, Inc.
Svivot
Symtrax
Tacit Knowledge Systems, Inc.
TARGIT Software
TheBrain Technologies
ThoughtShare Communications, Inc.
Tower Technology
Universal Document Management Systems
Verity Products
Virtual Image Technology
WebSoft Systems
Xerox Connect
Xerox Global Services
Xyvision Enterprise Solutions, Inc.

Appendix 3: Knowledge Management Job Categories.

The table below offers a succinct job classification schema. [**33**]

Other sources or sites where knowledge management jobs are discussed include

- Brint's Business Technology and Knowledge Management Executive and Professional Positions: http://www.brint.com/km/ken/jobs.html
- eKnowledgeCenter: http://www.metainnovation.com/km_jobs/display.asp

Knowledge & Innovation Professionals:
Individuals have strong background in shaping and formulating knowledge-based programs. Many have developed best practices for global Fortune 1000 Companies. Most are highly skilled in a variety of disciplines including business process improvement, innovation, performance measurement & modeling, case history, facilitation, strategic integration and developing best practices. Chief Knowledge Officers are part of this group as are consultants.

Knowledge Management Professionals:
Knowledge Management Professionals have expertise in implementation. They ensure a company gains from management of knowledge. They are involved in all phases of Innovation (Knowledge creation, knowledge acquisition, knowledge sharing, knowledge conversion, knowledge commercialization. Career background may be in any functions, e.g. Finance, Human Resources, Quality, IT, R&D, Manufacturing, Sales, Service).

Knowledge Catalogers, Researchers & Media Specialists:
These are contributors whose skills are web site, internet and intranet developers, librarians, catalogue specialists, content developers, communicators, software designers and developers, middle managers and others who create the knowledge networks and links.

Knowledge & Competitive Intelligence Professionals:
Emphasis focuses on competitive intelligence. Heavy research, the ability to create and develop solid positions, on line research savvy mixed with the ability to cogently and concisely present ideas in a clear and concise format are well developed skills. Writing and presentation skills are strong.

Knowledge & Strategic Integration Professionals:
Composed of top strategists, thinkers, planners, marketers, and individuals with senior management experience. These folks make planning and strategy the engine for business improvement and growth.

Knowledge Academicians, Theorists & Visionaries:
This group focuses primarily on discussion within an academic setting and developing and testing models and applicati ons. Visionaries are thought leaders who are frequently well in front of the practice. These individuals make outstanding speakers and can stimulate your organizations thinking.
Knowledge Facilitators, Trainers & Corporate Educators:
These individuals focus on learning and education in a corporate setting. Many have created outstanding models and programs for linking external and internal audiences, designing and developing curriculums, implementing distance learning and creating custom-tailored courses for executives and senior managers.

Knowledge & Expert Systems Professionals:
One facet of knowledge and knowledge management is expert systems and how to institutionalize corporate knowledge. Individuals in this area include Systems specialists, Technologists, Chief Information Officers, Technology Transfer Specialists, Expert Systems Engineers, Project managers and others who primarily focus on information technology.

Appendix 4: Target Work Processes

The following processes are cited from the APQC Process Framework. Originally, the framework originated in the context of the need for benchmarking. However, the contents provide an effective way to identify specific work processes that are associated with particular knowledge management technology.

Source: APQC Process Framework, American Productivity and Quality Center: http://www.apqc.org/

1. Understand Markets and Customers
1.1 Determine customer needs and wants
1.1.1 Conduct qualitative assessments
1.1.1.1 Conduct customer interviews
1.1.1.2 Conduct focus groups
1.1.2 Conduct quantitative assessments
1.1.2.1 Develop and implement surveys
1.1.3 Predict customer purchasing behavior
1.2 Measure customer satisfaction
1.2.1 Monitor satisfaction with products and services
1.2.2 Monitor satisfaction with complaint resolution
1.2.3 Monitor satisfaction with communication
1.3 Monitor changes in market or customer expectations
1.3.1 Determine weaknesses of product/service offerings
1.3.2 Identify new innovations that are meeting customer needs
1.3.3 Determine customer reactions to competitive offerings

2. Develop Vision and Strategy
2.1 Monitor the external environment
2.1.1 Analyze and understand the competition
2.1.2 Identify economic trends
2.1.3 Identify political and regulatory issues
2.1.4 Assess new technology innovations
2.1.5 Understand demographics
2.1.6 Identify social and cultural changes
2.1.7 Understand ecological concerns
2.2 Define the business concept and organizational strategy
2.2.1 Select relevant markets
2.2.2 Develop long-term vision
2.2.3 Formulate business unit strategy
2.2.4 Develop overall mission statement
2.3 Design the organizational structure and relationships between organizational units
2.4 Develop and set organizational goals

3. Design Products and Services
3.1 Develop new product/service concept and plans
3.1.1 Translate customer wants and needs into product and/or service requirements
3.1.2 Plan and deploy quality targets
3.1.3 Plan and deploy cost targets
3.1.4 Develop product life cycle and development timing targets
3.1.5 Develop and integrate leading technology into product/service concept
3.2 Design, build, and evaluate prototype products or services
3.2.1 Develop product/service specifications
3.2.2 Conduct concurrent engineering
3.2.3 Implement value engineering
3.2.4 Document design specifications
3.2.5 Develop prototypes
3.2.6 Apply for patents
3.3 Refine existing products/services
3.3.1 Develop product/service enhancements
3.3.2 Eliminate quality/reliability problems
3.3.3 Eliminate outdated products/services
3.4 Test effectiveness of new or revised products or services
3.5 Prepare for production
3.5.1 Develop and test prototype production process
3.5.2 Design and obtain necessary material and equipment
3.5.3 Install and verify process or methodology
3.6 Manage the product/service development process

4. Market and Sell
4.1 Market products or services to relevant customer segments
4.1.1 Develop pricing strategy
4.1.2 Develop advertising strategy
4.1.3 Develop market messages to communicate benefits
4.1.4 Estimate advertising resources and capital requirements
4.1.5 Identify specific target customers and their needs
4.1.6 Develop sales forecast
4.1.7 Sell products or services
4.1.8 Negotiate terms
4.2 Process customer orders
4.2.1 Accept orders from customers
4.2.2 Enter orders into production and delivery process

5. Produce and Deliver for Manufacturing-Oriented Organization
5.1 Plan for and acquire necessary resources or inputs
5.1.1 Select and certify suppliers
5.1.2 Purchase capital goods
5.1.3 Purchase materials and supplies
5.1.4 Acquire appropriate technology
5.2 Convert resources or inputs into products
5.2.1 Develop and adjust production process (for existing process)
5.2.2 Schedule production
5.2.3 Move materials and resources
5.2.4 Make product
5.2.5 Package product
5.2.6 Warehouse and store product
5.2.7 Stage products for delivery
5.3 Make delivery
5.3.1 Arrange product shipment
5.3.2 Deliver products to customers
5.3.3 Install product
5.4 Manage and produce delivery process
5.4.1 Document and monitor order status
5.4.2 Manage inventories
5.4.3 Ensure product quality
5.4.4 Schedule and perform maintenance
5.4.5 Monitor environmental constraints

6. Produce and Deliver for Service-Oriented Organization
6.1 Plan for and acquire necessary resources
6.1.1 Select and certify suppliers

6.1.2 Purchase materials and supplies
6.1.3 Acquire appropriate technology
6.2 Develop human resources skills
6.2.1 Define skills requirements
6.2.2 Identify and implement training
6.2.3 Monitor and manage skill development
6.3 Deliver service to the customer
6.3.1 Confirm specific service requirements for individual customer
6.3.2 Identify and schedule resources to meet service requirements
6.3.3 Provide the service to specific customers
6.4 Ensure quality of service

7. Invoice and Service Customers
7.1 Bill the customer
7.1.1 Develop, deliver, and maintain customer billing
7.1.2 Invoice the customer
7.1.3 Respond to billing inquiries
7.2 Provide after-sales service
7.2.1 Provide post-sales service
7.2.2 Handle warranties and claims
7.3 Respond to customer inquiries
7.3.1 Respond to information requests
7.3.2 Manage customer complaints

8. Develop and Manage Human Resources
8.1 Create human resource strategies
8.1.1 Identify organizational strategic demands
8.1.2 Determine human resource costs
8.1.3 Determine human resource requirements
8.1.4 Define human resources organizational role
8.2 Cascade strategy to work level
8.2.1 Analyze, design, or redesign work
8.2.2 Define and align work outputs and metrics
8.2.3 Define work competencies
8.3 Manage deployment of personnel
8.3.1 Plan and forecast work force requirements
8.3.2 Develop succession and career plans
8.3.3 Recruit, select, and hire employees
8.3.4 Create and deploy teams
8.3.5 Relocate employees
8.3.6 Restructure and right-size work force
8.3.7 Manage employee retirement
8.3.8 Provide outplacement support
8.4 Develop and train employees
8.4.1 Align employee and organization development needs
8.4.2 Develop and manage training programs
8.4.3 Develop and manage employee orientation programs
8.4.4 Develop functional/process competencies
8.4.5 Develop management/leadership competencies
8.4.6 Develop team competencies
8.5 Manage employee performance, reward, and recognition
8.5.1 Define performance measures
8.5.2 Develop performance management approaches/feedback
8.5.3 Manage team performance
8.5.4 Evaluate work for market value and internal equity
8.5.5 Develop and manage base and variable compensation
8.5.6 Manage reward and recognition programs
8.6 Ensure employee well-being and satisfaction
8.6.1 Manage employee satisfaction
8.6.2 Develop work and family support systems
8.6.3 Manage and administer employee benefits
8.6.4 Manage workplace health and safety
8.6.5 Manage internal communications
8.6.6 Manage and support workplace diversity
8.7 Ensure employee involvement
8.8 Manage labor-management relations
8.8.1 Manage collective bargaining process
8.8.2 Manage labor-management partnerships
8.9 Develop Human Resources Information Systems (HRIS)

9. Manage Information Resources
9.1 Plan for information resource management
9.1.1 Derive requirements from business strategies
9.1.2 Define enterprise system architecture
9.1.3 Plan and forecast information technologies/methodologies
9.1.4 Establish enterprise data standards
9.1.5 Establish quality standards and controls
9.2 Develop and deploy enterprise support systems
9.2.1 Conduct specific needs assessments
9.2.2 Select information technologies
9.2.3 Define data life cycles
9.2.4 Develop enterprise support systems
9.2.5 Test, evaluate, and deploy enterprise support systems
9.3 Implement systems security and controls
9.3.1 Establish systems security strategies and levels
9.3.2 Test, evaluate, and deploy systems security and controls
9.4 Manage information storage and retrieval
9.4.1 Establish information repositories (databases)
9.4.2 Acquire and collect information
9.4.3 Store information
9.4.4 Modify and update information
9.4.5 Enable retrieval of information
9.4.6 Delete information
9.5 Manage facilities and network operations
9.5.1 Manage centralized facilities
9.5.2 Manage distributed facilities
9.5.3 Manage network facilities
9.6 Manage information services
9.6.1 Manage libraries
9.6.2 Manage business records and documents
9.7 Facilitate information sharing and information centers
9.7.1 Manage external communications systems
9.7.2 Manage internal communications systems
9.7.3 Prepare and distribute publications
9.8 Evaluate and audit information quality

10. Manage Financial and Physical Resources
10.1 Manage financial resources
10.1.1 Develop budgets
10.1.2 Manage resource allocations
10.1.3 Design capital structure
10.1.4 Manage cash flow
10.1.5 Manage financial risk
10.2 Process finance and accounting transactions
10.2.1 Process accounts payable
10.2.2 Process payroll
10.2.3 Process accounts receivables, credits, and collections
10.2.4 Close the books
10.2.5 Process benefits and retiree information
10.2.6 Manage travel and entertainment expenses
10.3 Report information
10.3.1 Provide external financial information
10.3.2 Provide internal financial information
10.4 Conduct internal audits
10.5 Manage the tax function
10.5.1 Ensure tax compliance
10.5.2 Plan tax strategy
10.5.3 Employ effective technology
10.5.4 Manage tax controversies
10.5.5 Communicate tax issues to management
10.5.6 Manage tax records
10.6 Manage physical resources
10.6.1 Manage capital planning
10.6.2 Acquire and redeploy fixed assets
10.6.3 Manage facilities
10.6.4 Manage physical risk

11. Execute Environmental Management Program

11.1 Formulate environmental management strategy
11.2 Ensure compliance with regulations
11.3 Train and educate employees
11.4 Implement pollution prevention program
11.5 Manage remediation efforts
11.6 Implement emergency response program
11.7 Manage government, agency and public relations
11.8 Manage acquisition/divestiture environmental issues
11.9 Develop and manage environmental information system
11.10 Monitor environmental management program

12. Manage External Relationships
12.1 Communicate with shareholders
12.2 Manage government relationships
12.3 Build lender relationships
12.4 Develop public relations program
12.5 Interface with board of directors
12.6 Develop community relations
12.7 Manage legal and ethical issues

13. Manage Improvements and Change
13.1 Measure organization performance
13.1.1 Create measurement systems
13.1.2 Measure product and service quality
13.1.3 Measure cost of quality
13.1.4 Measure cost
13.1.5 Measure cycle time
13.1.6 Measure productivity
13.2 Conduct quality assessment
13.2.1 Conduct quality assessments based on external criteria
13.2.2 Conduct quality assessments based on internal criteria
13.3 Benchmark performance
13.3.1 Develop benchmarking capabilities
13.3.2 Conduct process benchmarking
13.3.3 Conduct competitive benchmarking
13.4 Improve processes and systems
13.4.1 Create commitment for improvement
13.4.2 Implement continuous improvement
13.4.3 Reengineer business processes and systems
13.4.4 Manage transition to change
13.5 Implement TQM
13.5.1 Create commitment for TQM
13.5.2 Design and implement TQM systems
13.5.3 Manage TQM life cycle

Appendix 5: Knowledge Management Work Processes

The list of knowledge management work processes includes twelve processes.

1. Leading, Visioning, Strategizing
2. Designing
3. Managing Categories of Information
4. Managing Knowledge Assets
5. Eliciting
6. Training & People Development
7. Recognizing and Rewarding
8. Communicating
9. Managing Information Technology
10. Documenting
11. Auditing & Evaluating
12. Managing Facilities

Source: This framework was adopted from material produced by Knowledge Harvesting Inc. (www.knowledgeharvesting.com)

1. Leading, Visioning, Strategizing
   - 1.1. Formulate a knowledge-oriented vision for your project, team, division, or organization.
   - 1.2. Integrate knowledge management with organizational strategy.
   - 1.3. Devise organizational policies for knowledge management.
   - 1.4. Assess organizational readiness for knowledge management.
   - 1.5. Assess cultural issues and extent of change management.
   - 1.6. Develop the business case for knowledge management.
   - 1.7. Establish a knowledge-management function.
   - 1.8. Create a budget for a knowledge management initiative.
   - 1.9. Create policies for protecting knowledge assets (patents, trademarks, licenses, copyrights, trade secrets, know-how).
2. Designing
   - 2.1. Design a knowledge management system architecture.
   - 2.2. Design knowledge acquisition processes and systems.
   - 2.3. Design knowledge application processes and systems.
   - 2.4. Design knowledge evaluation processes and systems.
   - 2.5. Design knowledge retention processes and systems.
   - 2.6. Design a system to collect and manage metaknowledge.
   - 2.7. Start a knowledge management program by reusing parts of an existing quality/process improvement program.
3. Managing Categories of Information
   - 3.1. Determine the approach or rules for classifying collections.
   - 3.2. Determine who can change ontologies and classification schemes.
   - 3.3. Determine how to change or add metadata for characterizing knowledge assets.
   - 3.4. Determine when to merge ontologies.
   - 3.5. Assess consistency among existing ontologies.
   - 3.6. Determine metadata parameters and a process for use and administration.
   - 3.7. Devise the parameters of user profiles.
4. Managing Knowledge Assets
   - 4.1. Establish an enterprise-wide Glossary.
   - 4.2. Establish a portfolio of knowledge assets.
   - 4.3. Mine data and information in publications and other printed and electronic media.
   - 4.4. Evaluate a knowledge asset's effectiveness, efficiency, and patterns of use.
   - 4.5. Formalize know-how into various learning/performance media.
   - 4.6. Improve outputs and cycle time associated with a knowledge asset.
   - 4.7. Optimize the modules/components of a knowledge asset.
   - 4.8. Select a knowledge interchange standard: SGML, KQML, KIF, ADL Metadata
   - 4.9. Deploy a knowledge asset to its target users/learners.
   - 4.10. Localize a knowledge asset (to language and culture).
   - 4.11. Package knowledge assets for external organization(s).
   - 4.12. Embed knowledge assets into products.

4.13. Embed knowledge assets into services.
4.14. Integrate a knowledge schema into microprocessor technology.
4.15. Sell or license knowledge assets.
4.16. Trade knowledge assets.

5. Eliciting
   5.1. Create work profiles.
   5.2. Index people, skills, and know-how.
   5.3. Find credible sources of knowledge (people/experts).
   5.4. Elicit know-how from expert(s).
   5.5. Elicit supplier, partner or customer-related knowledge.
6. Training & People Development
   6.1. Build trust necessary for knowledge management.
   6.2. Create personal responsibility for knowledge management.
   6.3. Develop rewards and recognition for knowledge management projects.
   6.4. Evaluate and buy knowledge management learning resources.
   6.5. Identify issues related to cultural transformations.
   6.6. Identify the key ideas to communicate for gaining commitment for knowledge management.
   6.7. Introduce: A functional definition of knowledge management.
   6.8. Introduce: Distinctions/definitions among/of data, information, and tacit, implicit and explicit knowledge.
   6.9. Introduce: Key Concepts in Knowledge management.
   6.10. Introduce: The Evolution of Knowledge Management Practices.
   6.11. Introduce: Why Knowledge management is a Business Requirement Now.
   6.12. Introduce: Relationship Between Knowledge management and Value.
7. Recognizing and Rewarding
   7.1. Derive compensation parameters based on knowledge-transfer objectives.
   7.2. Align knowledge management with existing performance measurement and compensation system.
   7.3. Measure the scope and maturity of an individual's (articulated) knowledge base.
   7.4. Measure the scope and maturity of an organization's (articulated) knowledge base.
8. Communicating
   8.1. Develop a Communications Plan for knowledge management.
   8.2. Communicate value of knowledge-based assets to external stakeholders (suppliers, customers, and partners).
   8.3. Educate suppliers and partners (about basic concepts of knowledge management).
   8.4. Communicate value of knowledge-based assets to stakeholders.
   8.5. Create promotional materials which accentuate benefits of knowledge-oriented approach.
9. Managing Information Technology
   9.1. Design the specifications of a corporate / organizational memory.
   9.2. Select information technologies and match with business requirements and knowledge management.
   9.3. Create a methodology and interface/ front-end for data-mining.
   9.4. Design and develop knowledge-based applications for performance support.
   9.5. Enable knowledge management through an intranet.
   9.6. Enhance the interface and extend the capabilities of your intranet's functions.
   9.7. Establish a channel for managing knowledge between organization and customers.
   9.8. Evaluate an IT product in relation to a specific knowledge management objective.
   9.9. Integrate knowledge-management technology with information technologies.
   9.10. Modify commercial search engine to organization's specifications.
10. Documenting
   10.1. Disclose an invention.
   10.2. Prepare claims for patents.
   10.3. File a copyright.
   10.4. File a patent.
   10.5. Document a trade secret.
11. Auditing & Evaluating
   11.1. Conduct knowledge audits to measure the source, flow, sinks and gaps.
   11.2. Map knowledge flows between organizations.
   11.3. Establish the parameters of the value proposition.
   11.4. Develop a methodology for valuing knowledge assets.
   11.5. Assess the alignment between the business imperatives and knowledge management.
   11.6. Benchmark knowledge management processes and systems.
   11.7. Measure the cost and return on investment of a knowledge management project.
   11.8. Create aggregate measures (and charts) for an individual's, team's, or unit's knowledge base.
12. Managing Facilities
   12.1. Establish a filing / organization system for physical files and artifacts.
   12.2. Integrate records management system with knowledge management.
   12.3. Re-design the physical work environment.

Appendix 6: Suggestions for Future Knowledge Management Technology

The purpose of this Appendix is to highlight several issues or ideas that may influence future knowledge management technology.

Expand the tacit-explicit dichotomy.

Is the tacit-explicit dichotomy too simplistic or should some other definable traits of knowledge be put forth? When studying the promotional literature of the KM technology vendors, many have adopted a model of knowledge sharing that should be questioned. During the 1990s, Nonaka [**31**] popularized the distinction between tacit and implicit knowledge, which he borrowed from Polyani [**32**]. However, Walsham [**30**] states that "whilst he himself (Nonaka) seemed to have a good grasp of Polanyi's thinking, Nonaka's work is sometimes used to justify approaches which are not in the spirit of the original ideas."

In response, Frappaolo [**7**] offers these insights. In some cases, knowledge believed to be tacit is only so labeled because no one has every taken the time or energy to codify the knowledge. This is a real problem and one not easily resolved. You must determine if bodies of uncoded knowledge can be captured and made explicit. Certain knowledge can be harvested from its owner and codified in such a way as to make it more readily sharable. Using such a process you can create a third type of knowledge in the organization: implicit knowledge. The value and leveragability of implicit knowledge is vast. Getting to implicit knowledge mandates taking a second look at all so-called tacit knowledge resources to determine whether that knowledge could be codified if it were subjected to some type of mining and translation process. Implicit knowledge management employs tools, techniques and methodologies that capture these previously elusive processes and make them more generally available to the organization. Thus, the thought processes used by your best thinkers become a leveragable asset for the organization. Finally, there are some intellectual assets too novel for capture and transfer. The goal of implicit knowledge management is to determine how much of the tacit knowledge in your organization defies any form of codification and to mine that which does not.

Clearly, it is vital to clearly characterize and differentiate tacit, implicit and explicit knowledge. This way, knowledge management technologies will be more accurately aligned with the knowledge sharing intent.

Characterize exchanges between agents.

One of the primary knowledge management technology functions cited in this paper was agents. In the technology context, agents are usually seen as automated functions which enhance the technology experience. In the future, the opportunity is to determine which agents – automated, individuals, teams, organizations or organizational networks – are the

most effective agents for achieving the varied goals of knowledge management. The following questions might provide some insights:

- What are the exchanges that occur between these agents?
- Which agent is most adept at performing a particular KM task?
- Can the organization indeed assimilate knowledge like an individual can or is it only capable of processing information?

Responses to these questions will help to orient knowledge sharing policies and practices and achieve an effective medium-oriented division of labor.

Furthermore, vendors would benefit from fully characterizing places where storage of information must occur. These places represent opportunities for value-added products and solutions because they serve as a focal point for communications. These are also the place where the information exchange between learning agents – between individuals and groups and organizations – naturally occurs.

Integrate a valid learning cycle.

Knowledge management technology researchers, practitioners, and vendors would benefit from exploiting the widespread acknowledgement of learning cycles. The research of psychologists (Dewey, Piaget, Bruner), organizational theorists (Lewin, Lippitt, Argyris and Schon, and Kolb), as well as advocates of Continuous Improvement and Total Quality Management (Deming) propose that learning is a cyclical process involving action, observation, assessment, design and subsequent action. Each of these four learning activities offers significant opportunity for enhancement via information and communications technologies.

Learning in and between organizations is inherently problematic. People take action and make decisions often do not get useful feedback. Therefore, learning functions are needed to manage the learning processes of observing, assessing, designing and implementing. Consider aligning functions and features with actions and sub-actions such as Observe, Assess, Design, and Implement. For example:

Observe	Categorization, Search, Visualization
Assess	Decision support
Design	Collaboration
Implement	Agents, Content management, Portal, Workflow

Align technology functions with work processes.

To date, the most common way that KM technology vendors have portrayed their offerings is in alignment with broad processes such as creating, learning, sharing, organizing, and discovering. In fact, this paper organized KM functions according to a structure offered by the Delphi Group which is intermediation, externalization, internalization, and cognition.

In contrast, there have been few KM technology products which optimize the possible relationships between KM technology functions and actual work processes. There have been

two notable exceptions: call centers and sales force automation. This work has been explicitly supported by varied sets of portal technologies. However, many opportunities are still available. The goal is to determine which organizational and inter-organizational processes are most effectively accomplished via certain sets of KM technology functions.

For example, a high-level list of organizational processes is likely to include most or all of the following:

- articulating vision and strategy
- delivering products and services
- designing products and services
- developing people
- invoicing customers
- managing change
- managing finances
- managing improvement
- managing information and information technology
- managing physical resources
- managing relationships with suppliers
- marketing and selling
- measuring customer satisfaction
- producing products and services
- servicing customers
- understanding markets and customer needs

Which particular KM technology features should be matched to each of these processes?

Define learning-related constructs.

Although, there has been a significant amount of information written on the "knowledge food chain" (data, information, knowledge), there is still widespread confusion about this set of terms. In particular, the definitions associated with learning," "information" and "knowledge" are imprecise. This imprecision has resulted in widespread misuse of terms. Therefore, effective analyses, characterizations, and comparisons are not possible.

The need is to accurately define learning-related constructs and enforce the meanings. Perhaps the emerging standards offer a vehicle for accomplishing this goal.