

Knowledge Management: An Emerging Discipline Rooted in a Long History

Karl M. Wiig

Knowledge Research Institute, Inc.–kmwiig@krii.com

Draft of Chapter 1 in

Knowledge Management

Edited by Daniele Chauvel & Charles Despres

Scheduled for publication Fall, 1999.

Abstract

Introduction

History of Knowledge Management

Intellectual Roots of Knowledge Management

Different Brands of Knowledge Management

Knowledge and Information: The Need for Crisp Definitions

Driving Forces behind Knowledge Management

External Driving Forces

Internal Driving Forces

Ongoing Developments

What Is New?

What May Lie ahead for Knowledge Management?

The Changing Workplace

Towards a Knowledge Management Discipline

Concluding Perspectives

References

Notes

Knowledge Management: An Emerging Discipline Rooted in a Long History

Karl M. Wiig

Knowledge Research Institute, Inc. – kmwiig@krii.com

Abstract

The business direction we call Knowledge Management (KM) has emerged over the last decades as a result of many intellectual, societal, and business forces. Some of its roots extend back for millennia, both in the West and the East, while others, particularly those associated with Cognitive and Information sciences, are quite recent. Globalization of business also plays an important role. Whereas KM has become a valuable business tool, its complexity is often vexing, and as a field, will still be under development for a long time to come. Significant changes in the workplace have already taken place, but changes to come are expected to be greater. As for other management directions, it is expected that KM will be integrated into the basket of effective management tools, and hence disappear as a separate effort.

Introduction

Knowledge, what it is, what it means, and its roles for work and spiritual life, has a long history. The abstract considerations and speculations by philosophers and religious thinkers have been of particular significance. In addition, the emphasis on knowledge has always had a practical work-related and secular side. It is this aspect we pursue in this chapter.

Knowledge in the workplace—the ability of people and organizations to understand and act effectively—has regularly been managed by managers, coworkers, and proactive individuals. Those responsible for survival in competitive environments always have worked to build the best possible knowledge within their area of responsibility.

Knowledge, and other IC components, serve two vital functions within the enter-

prise.¹ They form the fundamental resources for effective functioning and provide valuable assets for sale or exchange. From business perspectives, explicit and systematic knowledge management has not been of general concern until recently, and as a result, availability of competitive expertise has been haphazard. This is now changing.

As we improve KM—and as our competitors improve—we must continue to develop of our KM practices. These efforts, which become increasingly sophisticated and demanding, must build upon the historic roots of knowledge-related considerations. In addition we must pay attention to developments in technology and people-centric areas like cognitive sciences. In other words, we must rediscover the power of past thinking as well as understand opportunities that lie ahead.

¹ See for example Stewart (1997) and Sveiby (1997).

History of Knowledge Management

A historical perspective of today's KM, indicates that this is an old quest. Knowledge, including knowing and reasons for knowing, were documented by Western philosophers for millennia, and with little doubt, long before that. Eastern philosophers have an equally long documented tradition of emphasizing knowledge and understanding for conducting spiritual and secular life. Much of these efforts were directed to obtain theoretical and abstract understandings of what knowledge is about.²

Practical needs to know—or particularly, needs for expertise and operational understanding—have been important since the battle for survival first started, perhaps before the first human. Managing practical knowledge was implicit and unsystematic at first, and often still is! However, the craft-guilds and apprentice-journeyman-master systems of the 13th century, were based on systematic and pragmatic KM considerations. Still, the practical concerns for knowledge and the theoretical and abstract epistemological and religious perspectives were not integrated then, and still are mostly kept separate.

Our present focus on knowledge, particularly for KM, is often explicitly oriented towards commercial effectiveness. However, there are emerging realizations that to achieve the level of effective behavior required for competitive excellence, the whole

² The epistemological considerations of the Greek philosophers Socrates, Plato, and Aristotle are well known. Perhaps less known in the West are the teachings of Lao Tzu and Confucius in China, also about 2,500 years ago. Indian philosophers also pursued similar topics.

person must be considered. We must integrate cognition, motivation, personal satisfaction, feeling of security, and many other factors.³

The present KM focus is not driven by commercial pressures alone. A practical, often implicit, aspect of KM is that effective people behavior required for success rests on delegating intellectual tasks and authority to knowledgeable and empowered individuals. KM also represents an evolution of the move towards personal and intellectual freedom that started with the age of enlightenment and reason over 200 years ago. One notion was that through proper education, humanity itself could be altered, its nature changed for the better. As other social movements, this has taken a long time to penetrate, particularly into the conservative ranks and practices of management.⁴

The emergence of the explicit knowledge focus and the introduction of the term “KM” in the 1980s was no accident and did not happen by chance.⁵ Although it happened gradually and often was met with management uncertainty, it was a natural evolution brought about by the confluence of many factors. The developments that have led to our present perspectives on KM come from many areas. Some are intellectually

³ See for example Boulding (1966), Cleveland (1985), Drucker (1988), Stewart (1991), and Sveiby & Lloyd (1987).

⁴ Managers, by necessity have been conservative. Management is not a science, and approaches to “control” the social, open systems of human and economic behavior in organizations and markets are fraught with problems and uncertainty (see Austin, 1996 and Hilmer & Donaldson, 1996). Successful management approaches, therefore, are built on traditions and long experience.

⁵ A perspective of the history of KM can for example be found in Wiig (1997).

based, others are pragmatic and rooted in the need to innovate to secure real life performance.

From our present-day perspective, in spite of increasing advances in thinking, there were little change in needs for practical KM until the industrial revolution changed the economic landscape in the 17th century. The introduction of factories and the related systematic specialization became more pronounced to support the ability to create and deliver goods in greater quantities and at lower costs. Still, KM was implicit and largely based on the apprentice-journeyman-master model. Schools and universities mostly fulfilled a tacit mission to provide education as required for a leading minority. To some extent, this tacit perspective survives to this day. Education, be it primary, secondary, or higher, is perceived to be “good” and of general value, often with less thought given to which knowledge must be developed for which specific purposes.

Intellectual Roots of Knowledge Management

Intellectually, broad, present-day KM has many origins. One comes from abstract philosophical thinking. Another comes from concrete concerns for requirements of expertise in the workplace. Others come from perspectives of educators and business leaders. Recent perspectives come from efforts to explain economic driving forces in the “knowledge era” and the 20th Century efforts to increase effectiveness.⁶ Some of the intellectual roots include:

⁶ See Romer (1989) and Kelly (1996).

Historic Efforts

- Religion and Philosophy (e.g., epistemology) to understand the role and nature of knowledge and the permission of individuals “to think for themselves.”
- Psychology to understand the role of knowledge in human behavior.
- Economics and social sciences to understand the role of knowledge in society.
- Business Theory to understand work, and its organization.

20th Century Efforts to Improve Effectiveness

- Rationalization of Work (Taylorism), Total Quality Management, and Management Sciences to improve effectiveness.
- Psychology, Cognitive Sciences, Artificial Intelligence (AI), and Learning Organization to learn faster than competition and provide foundation for making people more effective.

These and other perspectives on the roots of KM are discussed by many authors.⁷

Different Brands of Knowledge Management

We must specify what we mean by, and include within broad KM. A few advanced enterprises pursue a central strategic thrust with four tactical foci as indicated in Figure 1. However, most tailor KM practices to their needs and environments and have narrower perspectives. Of these, some focus on knowledge sharing among individuals or on building elaborate educational and knowledge distribution capabilities. Some emphasize use of technology to cap-

⁷ See for example Cleveland (1987) op.cit., Senge (1990), Simon (1976), and Wiig (1993).

ture, manipulate, and locate knowledge and initially, many focus on knowledge-related information management rather than on KM. Others focus on knowledge utilization to improve the enterprise's operational and overall effectiveness. Still others pursue building and exploiting IC to enhance the enterprise's economic value. Some exceptional enterprises have created "knowledge-vigilant" environments to focus constant, widespread attention on ensuring competitive IC to sustain long-term success and viability. The presumption is that competitive IC, properly utilized and exploited, is the central resource behind effective behavior.

Our definition of KM is broad and embraces related approaches and activities throughout the organization. From this view, KM is partly practical, basic, and directly aimed at supporting the enterprise's ultimate objectives. Other parts of KM are quite sophisticated and rely on understanding of underlying processes to allow targeted KM focused on the organization's needs and capabilities. Many design systematic and explicit KM practices to create enterprise-wide, adaptive, contextual, comprehensive, and people-centric environments that promotes continual personal focus on knowledge-related matters.

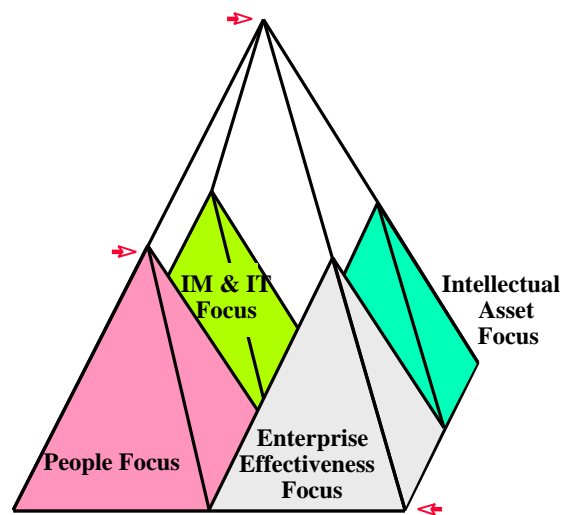


Figure 1. Comprehensive Knowledge Management Strategy Focus Areas.

Broad KM is the systematic and explicit management of knowledge-related activities, practices, programs, and policies within the enterprise. Consequently, the enterprise's viability depends directly on:

- The *competitive quality* of its knowledge assets; and
- The *successful application* of these assets in all its business activities—i.e., realization of the knowledge assets' value.

From a slightly different perspective: ***"The goal of Knowledge Management is to build and exploit intellectual capital effectively and gainfully."*** This goal is valid for the entire enterprise, for all of the enterprise's activities, and has considerable complexity behind it.⁸

⁸ Private communication from Fernando Simões, South African KM professional (1998). This definition was adopted by the Australian Parliament for their KM position paper.

Some aspects of enterprise-wide intelligent-acting behavior are indicated in Figure 2. The model outlines elements that fall under the auspices of KM, such as learning, innovating, and the effective creation and

application of knowledge assets (KAs). It also points to the need for permission, motivations, opportunities, and capabilities for individuals to act intelligently.

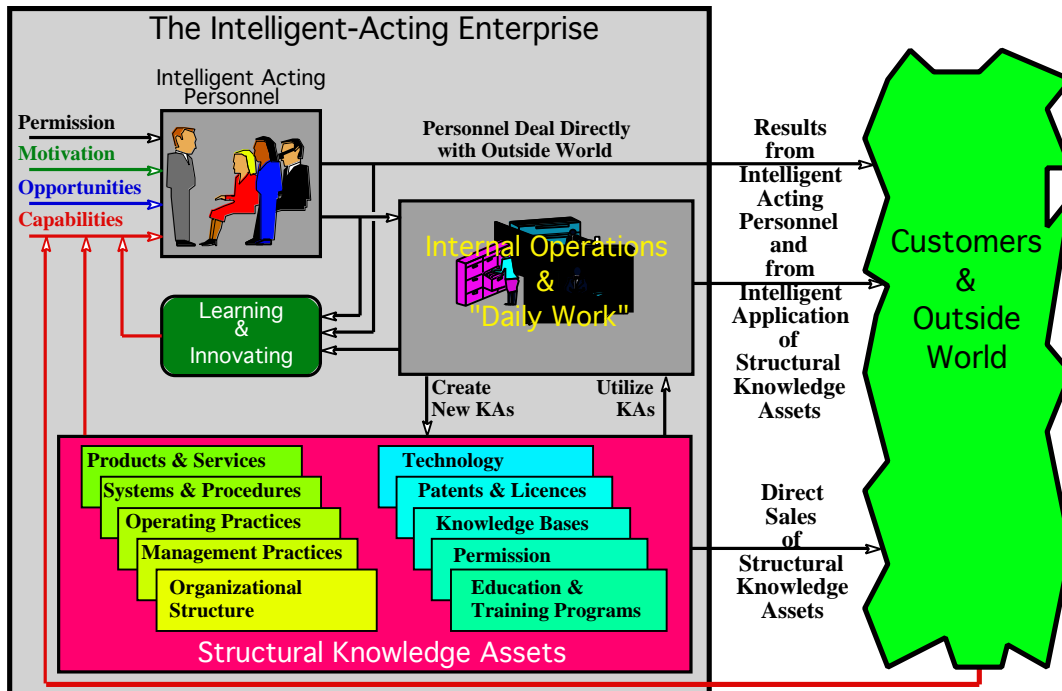


Figure 2. Individuals, Knowledge Assets, Learning and Innovation, and Internal Operations in the Effective Enterprise.

One important aspect for effective KM is the requirement to deal explicitly with the complexity of how people use their minds—that is, think—to conduct work. It concerns what they must understand and how they must possess specific areas of knowledge and have access to them to act effectively under different conditions. Similar considerations also hold on the organizational level.

Several aspects of effective, broad-based KM are of interest and should be emphasized. They dispel some myths often associated with KM and include:

- In the long run, KM initiatives and activities normally do not lead to more

work. Instead, improved knowledge and its use, often far down in the organization, lead to less rework and hand-offs, quicker analysis, decision, and execution, particularly of nonroutine tasks and other desirable and work-reducing effects.

- KM activities and initiatives, instead of being additional functions, must to the largest extent possible be based on, and be part of, pre-existing and ongoing efforts—often without making these more difficult, time consuming, or demanding.⁹
- People are often afraid to share their knowledge. They believe that they will lose the advantage that their ex-

⁹ Lucier and Torsilieri (1997)

expertise gives them among their peers and within the organization. However, under the best of circumstances, only a small fraction of an individual's applicable expertise can be elicited and shared. Frequently, only concrete, operational or routine knowledge can be communicated. Deep, broad insights are generally not available—and may not exist except as a capability to reason until the situation requires it. Importantly, when experts provide knowledge openly and widely, they tend to be considered important by their peers and gain status and recognition.

- Personal knowledge cannot be shared directly. Perspectives of, and information about knowledge can be communicated. Recipients make sense of the received information and internalize their interpretation of the communication as new knowledge. Knowledge is built by complex learning processes and result in highly individual mental models and associations that for some, may be quite different from the source knowledge.

To be competitive, proactive enterprises must increasingly manage knowledge systematically—although many KM activities and functions may be implicit in each employee's and department's daily work and practice. Enterprises will continue to be motivated by several end-goals, to secure short-term success and long-term viability. A particular KM objective in support of whichever strategy the enterprise pursues, is to leverage the best available knowledge and other ICs to make people, and therefore the enterprise itself, act as effectively as possible to deal with operational, customer, supplier, and all other challenges to implement the enterprise strategy in practice.

Knowledge and Information: The Need for Crisp Definitions

The intent with KM is to manage knowledge practically and effectively to reach broad operational and strategic objectives. That requires crystal-clear understanding of what is meant by knowledge. We must be specific about what knowledge is to manipulate, monitor, and judge how it affects—and is affected by—people, culture, KM activities, and other factors within the enterprise and its environment.

We must distinguish clearly between what we mean by “knowledge” and “information.”¹⁰ At first, it may appear that there is a continuum from signals to data to information to knowledge—and onwards, perhaps to wisdom. However, when examining the nature of these conceptual constructs and the processes that create them, we find discontinuities that make information fundamentally different from knowledge.

Most people think of knowledge as a recipe—a defined procedure—to deal with a concrete, routine situation. However, few situations are repeated—most situations are novel, particularly in their details. Hence,

¹⁰ From practical KM perspectives, operational definitions are: **Information** consists of facts and other data organized to characterize a particular situation, condition, challenge, or opportunity. **Knowledge** is possessed by humans or inanimate agents as truths and beliefs, perspectives and concepts, judgments and expectations, methodologies and know-how. Knowledge is used to receive information—to recognize and identify; analyze, interpret, and evaluate; synthesize, assess, and decide; adapt, plan, implement, and monitor—to act. **Understanding** based on knowledge is used to determine what a specific situation means and how to handle it. Following this definition, information and rudimentary knowledge may be codifiable and may exist outside a person's mind. Understanding, however, may be difficult to codify and is primarily people-based.

knowledge must provide us with the capability—the understanding—that permits us to envision possible ways of handling different situations and to anticipate implications and judge their effects. It allows us to improvise and “jam.”¹¹ Our knowledge—in the form of mental models, scripts, and schemata—provides us with the capability to work with novel situations by including not only concepts and predefined methods and judgments, but numerous connections with other detailed concepts, meta-concepts, and mental models.¹²

The discontinuity between information and knowledge, referred to above, is caused by how new knowledge is created from received information. The process is complex. To become knowledge, new insights are internalized by establishing links with already existing knowledge, and these links can range from firmly characterized relationships to vague associations. Prior knowledge is used to make sense of received information, and once accepted for inclusion, internalizes the new insights by linking with prior knowledge. Hence, the new knowledge is as much a function of prior knowledge as it is of received inputs. A discontinuity is thus created between the inputs and the resulting new knowledge. The resulting knowledge and understanding is formed by combinations of mental objects and links between them and allow us to sense, reason, plan, judge, and act.

A practical example portrays how information and knowledge differ. Consider the regular and supervisory control functions for an automated factory as illustrated in

Figure 3. In this system, information is continually obtained on the operating state of the process. Knowledge from process experts is embedded in the process control programs to automate operations. The experts provide personal knowledge and deep understanding as general principles and specific cases on how to deal with routine and undesired operating situations. They may pool their process knowledge with that of other experts who earlier have embedded knowledge on optimization and control principles in the generic computer software used to generate the control algorithms.

In addition, process operating history is analyzed (by conventional statistical methods or advanced knowledge discovery in databases [KDD]) to obtain selected process characteristics, including process dynamics. This information also becomes part of the control algorithms embedded in the control computer after it has been interpreted and linked to the experts' personal knowledge.

Driving Forces behind Knowledge Management

The emergence of KM may be explained by the confluence and natural evolution of several factors. The needs to manage knowledge are strong. For those who now are engaged in KM it is not an alternative or a luxury. It is a necessity driven by the forces of competition, market place demands, new operating and management practices, and the availability of KM approaches and information technology.

External Driving Forces

Most organizations operate in environments that they cannot control. Their viability and success are subject to external

¹¹ See Kao (1997).

¹² See for example Gardner (1983), Gardner (1985), Lakoff (1987), Schank & Abelson (1977), and Wiig (1995).

forces that they must live with and respond to as best they can to survive. Over the last decades considerable external driving forces

have emerged. Among these we find the following:

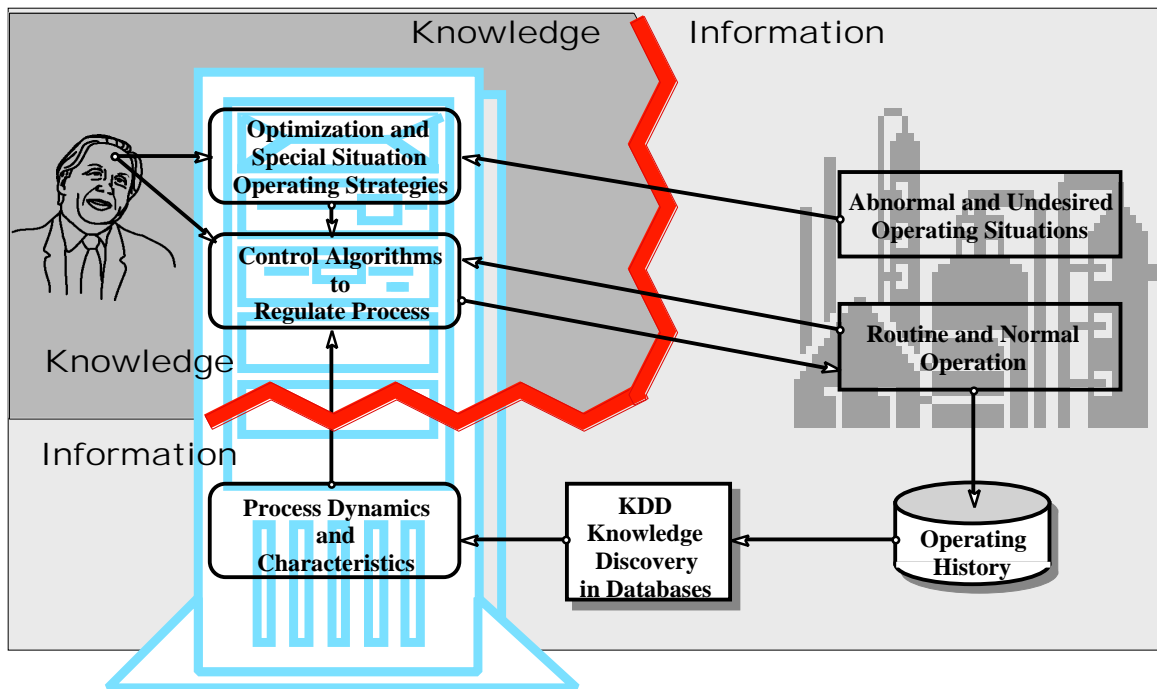


Figure 3. Differences between Knowledge and Information in Process Control.

- **Globalization of business and international competition.** International commerce has increased. Products that were created within one company or country are now assembled from parts from multiple sources world-wide. Where before there were few product alternatives, there now are many. Production and service capabilities that were available from limited sources in advanced countries, are frequently found in countries that were considered developing and incapable of sophisticated work. These developments have led to cut-throat competition—where only the most effective will survive by being effective in operations, marketing, and creation of products and services.
- **Sophisticated customers.** Customers have become more demanding. They increasingly desire customized products and services that support

their success and in turn are needed to serve their own customers better. Everywhere there are requirements for new features, better fulfillment of individual needs, higher quality, and quicker response—all at an increasingly feverish pace. To survive in this environment, enterprises must perform on par with—or better—than its competition by improving their understanding of customer needs and capabilities.

- **Sophisticated competitors.** Competing organizations are constantly implementing innovations in products, services, and practices. They also implement “discontinuous breakthroughs” by adopting new technologies and practices. To keep up, these changes require constant learning to build competitive expertise.
- **Sophisticated Suppliers.** Suppliers continue to improve their capabilities

and can participate in creating and supporting innovations to deliver sophisticated products. To take advantage of these opportunities, enterprises must understand new supplier capabilities and how to integrate them with internal efforts, directions, and culture.

Internal Driving Forces

Within enterprises, developments of many types have created opportunities for managing knowledge better, and in some cases differently. Examples of important changes include:

- **Bottlenecks in enterprise effectiveness.** Typically, enterprise effectiveness is limited by restrictions in flows of work, information, etc. Bottlenecks have been removed—and relocated to other sites—through many improvements: investments in technology and logistics; personnel working harder and longer; organized work tasks and work flows; improved information for decision making and other work (more accurate, complete, and timely); and increased intelligent automation of routine and simpler operational tasks.
New requirements place demands on increased effectiveness and intelligent behavior. Bottlenecks have moved from visible and tangible sites to knowledge-intensive work areas require better understanding and expertise.
- **Increased technological capabilities.** New KM approaches are made possible by advances in information management and technology and applied AI. Examples include groupware for collaborative work, knowledge encoding for knowledge bases, performance support systems, natural language understanding, and advanced search engines.
- **Understanding of human cognitive functions.** People and their work behavior are at the center of the effective enterprise. Therefore, it is important to incorporate better professional understanding of cognitive aspects of how knowledge—understanding, mental models, and associations—affect decision making and performing knowledge-intensive work when deciding how to conduct KM.

Ongoing Developments

Many developments are underway that will affect KM further and some of these include:

- **Economics of Ideas.** Innovations and new, path-breaking ideas have brought about knowledge-driven economic changes of societal significance.¹³
- **Information Management and Technology.** Information-related practices and capabilities are transforming the way business is conducted.
- **Cognitive Science.** Our understanding of how people function has direct impact for how we manage knowledge.
- **Shifts in Bottlenecks.** Understanding best practices and others' experiences provide information about potential candidates for streamlining operations.
- **Customization Requirements for Sophisticated Customers.** Great opportunities are available by satisfying unique customer demands on reasonable terms.
- **Sophisticated Competitors.** Threats require agile behaviors and rapid learning to remain viable

¹³ Romer (1989) and Kelly (1996), op. cit.

- **Globalization.** International business changes provide business opportunities and threats that must be understood to be managed.

These, and other driving forces encourage companies to focus attention and efforts to areas that provide greatest pay-back. In general, it requires delivering “more with less.” That, however, requires extensive understanding and ability to build and maintain competitive IC in many areas.

What Is New?

KM practitioners recognize that KM has brought new elements into the enterprise. Entirely new perspectives and activities are introduced. Others are not new *per sé*, but have taken on new roles. For example, there is little new in the concepts behind educating and training people to be able to deliver competent work. The same is true for many other KM-related activities. However, perspectives, priorities, and purposes are new.

Most knowledge-based organizations realize that the largest part of their market value is their IC, not the sum of their financial and tangible assets. They find that no one has specialized in understanding the mechanisms that govern the processes that result in valuable IC. They also realize that no one is responsible for maintaining and improving the value of these large assets.

What is new—certainly in the form of broadly accepted management thrusts—are the explicit, deliberate, and systematic approaches to orchestrate KM efforts and to rely upon their results to achieve enterprise objectives. From management’s point of view, the perspectives, coordination, facilitation, and monitoring activities necessary for active KM require new and different in-

sights, emphases, and approaches. They also require new values, insights, and priorities. What is more, they require a new focus on the role that knowledge and understanding play in the enterprise’s—and in individuals’—ability to deliver quality work.

Advanced KM now start to rely on new approaches that integrate theoretical and abstract perspectives of epistemology and cognitive sciences with the pragmatic considerations of expertise required to conduct business and the technical directions of information management and technology. Three additional conditions have also contributed to these developments. First of these are AI and management sciences concerns for how people reason and think when performing intellectual work and the effect of knowledge and understanding to deliver quality work.¹⁴ Second are learning theory, social sciences, and psychological concerns for approaches to effective learning, teamwork and collaboration, and for cognitive styles.¹⁵ Third are advances in information technology that allow extending KM practices into new areas by building on ontologies, NLU, automated reasoning, and intelligent agents.

New understandings of how people make decisions have made it clear that previous principles for managing knowledge may be misguided. It now is realized that most decisions are made based on “intuition” (strong associations) rather than on deliberate and systematic reasoning.¹⁶ This has considerable consequences for which knowledge people must possess and how they are supported to function effectively

¹⁴ See Suchman (1995).

¹⁵ Gardner (1983) *op.cit.*.

¹⁶ See Bechara et al. (1997) and Klein (1998).

and deliver quality work under various conditions.

What May Lie ahead for Knowledge Management?

KM promotes development and application of tacit, explicit, and embedded IC; that is, leveraging personal understanding, organizational action capabilities, and other intellectual assets to attain the enterprise's ultimate goals, such as ascertaining profitability, ensuring long-term viability, or delivering quality services. This perspective of KM, and given its history, suggest that a number of developments will take place in coming years. They include:

- An area of increasing insight in the role that understanding—or meaning-connected knowledge—and abstract mental models play in intellectual work. The 1990's notion that “knowledge is actionable information” and similar early perspectives will be replaced by more detailed characterizations of both personal and inanimate knowledge. Insights from cognitive research and business experiences with deep knowledge will elucidate what, and how, people must understand how to handle complex challenges competently.
- Caused by KM's importance, future practices and methods will be purposeful, systematic, explicit, and dependent upon advanced technology for knowledge capture and codification, automated reasoning, natural language understanding, and so on. Overall, KM will become people-centric since it is networking of competent and collaborating people that makes successful organizations.¹⁷
- Extensive experiences will spread from many organizations about how effective KM is organized, supported, and facilitated. Obvious changes will include placement and organization of the KM effort itself, be it a Chief Knowledge Officer (CKO) or a distributed effort. Changes that deal with reorganization of work and the abolishing of whole departments when their responsibilities are integrated into other operations, will be prevalent but less apparent.
- Management practices will change to facilitate KM. Incentives will be introduced and disincentives eliminated to promote innovation, effective knowledge exchange (“sharing”), learning, and application of best knowledge for work. Cultural drivers such as management emphasis and personal behaviors will be changed to create environments of trust and efforts to find root causes of problems without assigning blame.
- KM perspectives and considerations will be embedded in regular activities throughout the enterprise. An example of how broadly KM may affect an organization is indicated in Figure 4. It highlights some separate and shared responsibilities for KM-related activities within research and development (R&D), human resources (HR), information management and technology (IM & IT), and a KM supervisory function.
- New practices will focus on combining understanding, knowledge, skills, and attitudes (“KSAs”) when assembling work teams or analyzing requirements for performing work.¹⁸ The emphasis on complementary work teams will coincide with the movement towards virtual organizations where many in-house teams will include external workers who are brought in for

¹⁷ See Terry Winograd (1988), Cannon-Bowers & Salas (1999) op.cit., and Wellman (1999).

¹⁸ Cannon-Bowers & Salas (1999), op.cit.

Knowledge Management: An Emerging Discipline Rooted in a Long History

limited periods to complement in-house competencies for specific tasks. The present use of consultants from large consulting houses is one mani-

festation but is expected to increasingly involve self-employed external knowledge workers.

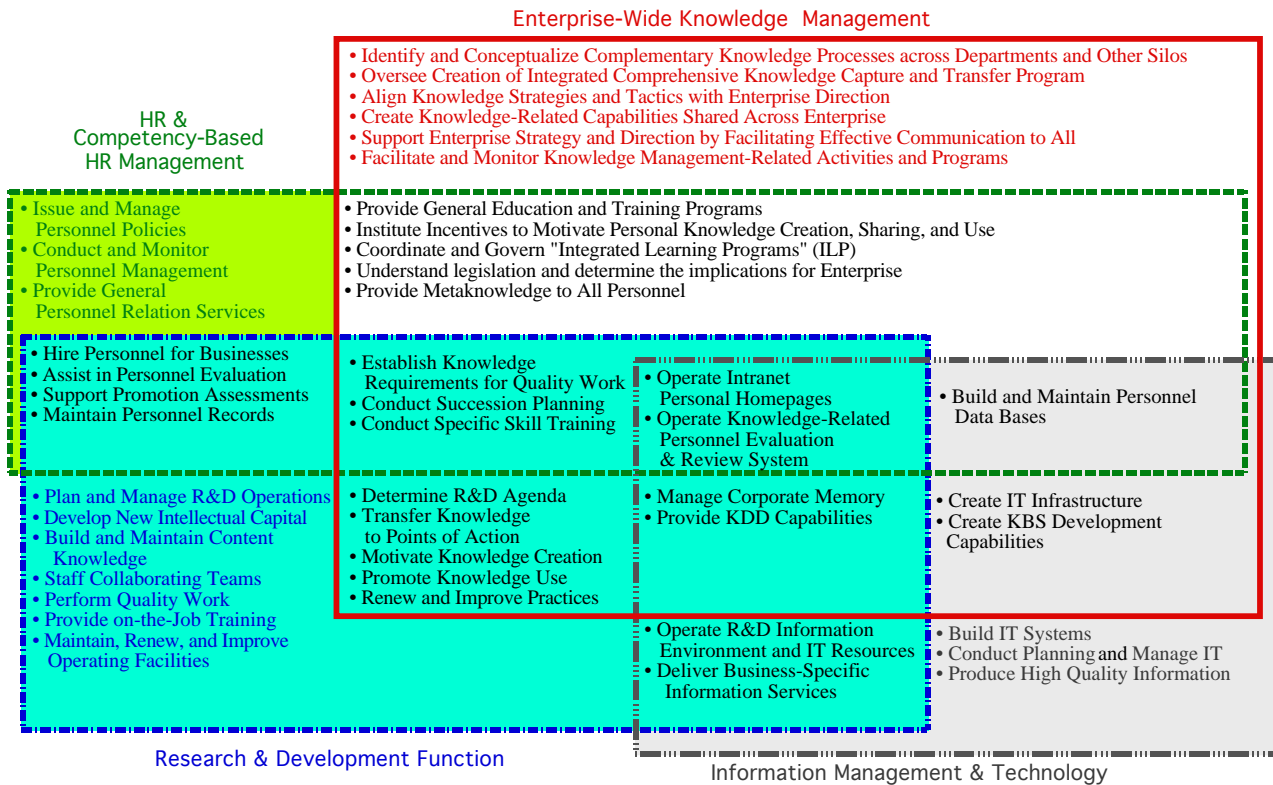


Figure 4. Examples of Sole and Shared Responsibility KM Activities.

- Most organizations will create effective approaches to transfer personal knowledge to structural IC to allow better utilization and leveraging. External subject matter experts will leverage and sell their expertise to many enterprises for continued use.¹⁹
- Comprehensive approaches to create and conduct broad KM practices will become the norm. For example, designing, implementing, and operating comprehensive multi-mode knowledge transfer programs will be common.²⁰ Such programs include systematic approaches to integrate primary

knowledge-related functions such as: sourcing from internal and external knowledge experts; knowledge capture, codification, and organization into repositories; deployment (e.g., training and educational programs, expert networks, and knowledge-based systems [KBSs]); and functions where work is performed or knowledge assets are sold, leased, or licensed.

- Education and knowledge support capabilities such as expert networks or performance support systems (PSSs) will be matched to cognitive and learning styles and dominant intelligences.²¹ That will help workers perform more effectively. Highly effective

¹⁹ See Edvinson & Malone (1997), Stewart (1991), Stewart (1997), and Sveiby (1997).

²⁰ Wiig (1995) p. 358 discusses such programs.

²¹ See Kurtzman (1999).

approaches to elicit and transfer deep knowledge will be introduced to allow experts to communicate understandings and concepts and facilitate building corresponding concepts, associations, and mental models by other practitioners.²²

- KM will be supported by many AI developments. Some of these are intelligent agents; natural language understanding and processing functions; reasoning strategies; and knowledge representations and ontologies²³ that will continue to be developed and, by providing greater capabilities, will be relied on to organize knowledge and facilitate application.

To create broad and integrated capabilities, most of the changes introduced by these developments will not be stand-alone, but will be combined with other changes, many of which have foci different from KM.

Increased specialization in enterprises to work with various KM aspects:

- On the Firm level: Expertise with emphasis on managing IC.
- On the middle management level: Understanding the importance of managing local investments in, and coordination and application of, knowledge assets to meet operating objectives.
- On the KM level: Enterprise-wide coordination and facilitation of KM-related functions, capabilities, and activities.
- On the knowledge-operational level: Local hands-on capabilities to obtain and organize knowledge, automate knowledge and build knowledge-based support and educational systems, and

retrieve and communicate knowledge to end users.

Realization that KM is the cornerstone of every knowledge-organization's strategy will bring about:

- New ways of working—collaboration, new ways of assembling expertise for special purposes.
- New roles for people management.
- New roles for training and education within the firm.
- New roles and methods for knowledge capture, organization, automation and deployment.
- New focus for management science on organization of work with knowledge perspective, change management to facilitate growth and innovation, and on KM details.
- New focus for strategy setting on developing knowledge- and IC-related opportunities and associated development of capabilities to realize and capitalize on the possibilities.

As organizations develop their KM practice further, most enterprises after some time will pursue all four thrusts as part of their overall KM strategy.

The Changing Workplace

We do expect the enterprise to change. Advances in KM practices will continue to modify the workplace—sometimes drastically. Visible changes will be evident by increased application of, and reliance on, technology for cognitive support compared to the information focus of the 1980s and 1990s. Less visible changes may be more important since they will improve the way people work with their minds and thereby alleviate bottlenecks. The changes that people will experience in the workplace include:

²² Wiig & Wiig (1999) discuss some existing approaches and the reasoning behind them.

²³ For an excellent discussion of ontologies and their role in KM, see Chandrasekaran et al (1999).

Knowledge Management: An Emerging Discipline Rooted in a Long History

- Emphasis on using interdisciplinary teams with focus on best mix of competencies and understanding to be

applied to the work at hand. Figure 5 shows an example of the proficiency profile of such a team.

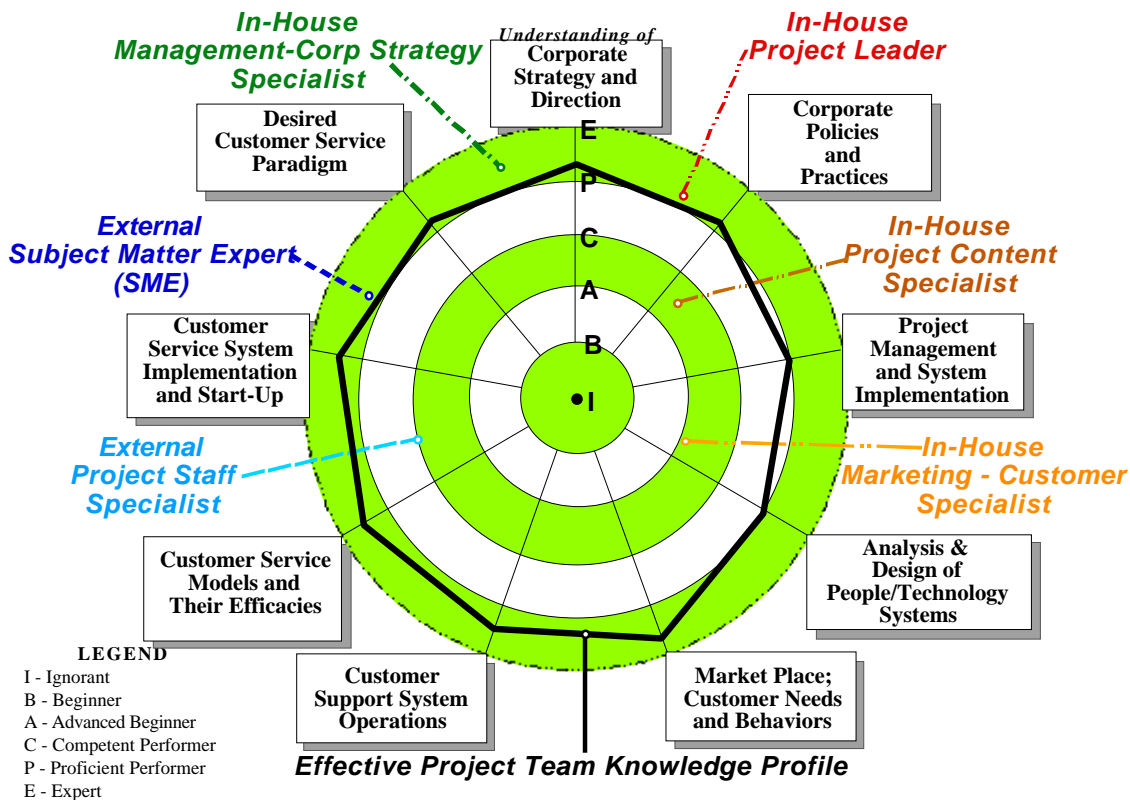


Figure 5. Knowledge Profile Example of a Virtual Team with Six Members.

- Temporary nature of many employment situations. Emphasis will be placed on assembling short-lived teams with complementing knowledge profiles to address specific tasks. People will improve their personal expertise to maintain and enhance personal competitiveness.
- Good understanding of the importance of relying upon strong mental associations and conceptual knowledge to guide direction of work.
- Better understanding by knowledge workers of how to implement enterprise strategy by the small decisions and acts that are part of their daily work.
- Greater willingness to collaborate with associates and coordinate with other activities.
- Increased personal understanding by employees of how they personally will benefit from delivering effective work.
- Greater job security and less hesitation to undertake complex tasks after employees build increased metaknowledge and professional or craft knowledge about work for which they are responsible.
- Increased reliance on automated intelligent reasoning to support work. For example, when confronted with complex situations, automation may assist knowledge workers by identifying and making available relevant support information and knowledge, making preliminary sense of the situation, and locating and presenting suggestions for how it should be handled.

- Intelligent agents deployed internally and externally will offload “data detective work” now required to locate and evaluate information required in many knowledge worker situations ranging from plant operators to *ad hoc* strategic task forces.
- New organization of the physical work environment will change the way people work together and allow greater richness and effectiveness of interaction. New work environments will be designed to foster knowledge exchange through networking and collaboration and facilitate innovations through serendipity.
- Improved understanding of different levels of work complexities and what that means for knowledge requirements. A useful categorization of work complexity consists of six levels:
 1. Routine worktasks (simple, repetitive, and well understood).
 2. Logical or less common variations (transformations) of routine situations.
 3. Complex, yet expected extensions of known routines integrated with external factors.
 4. Unexpected challenges (conditions), but with a mix of routines and external factors.
 5. Totally unexpected situations and non-routine challenges, yet within the larger job scope.
 6. Unusual challenges outside job scope.

In total, KM will lead to less effort to deliver present day service paradigms. However, as Figure 6 indicates, work is changing to satisfy the ever-increasing market requirements for new features and capabilities in products and services. Successful organizations will provide better script and schema knowledge and work will expand to

take advantage of the new capabilities. Even so, with increased responsibilities, knowledge workers are expected to feel more confident and have better understanding of work to be done. They also will receive better knowledge support and more jobs will be done right the first time, adding to confidence and job satisfaction on the inside, and better market acceptance on the outside.

The nature of work is changing. Already, we have learned to prepare our workforce better, automate many routine functions, and organize work to deliver higher quality products and services more effectively. There is a shift towards more complex work as outlined in Figure 6. There are many identifiable targets for intelligent automation in routine areas and potentials for application of greater understanding and expertise in more demanding work. Advanced technology and experiences by sophisticated organizations motivate continued refinement of work in general. Hence, to stay ahead of competitors, enterprises ask their personnel to engage in increasingly complex work to deliver better products and services. Service paradigms become more complex.

Towards a Knowledge Management Discipline

The changes to manage knowledge explicitly and in detail place great demands on supporting disciplines. They range from cognitive sciences and educational methods to management sciences and economics to AI and information management and technology. Enterprises pay new attention to maintaining and enhancing the competitive power of their IC. They realize that man-

Knowledge Management: An Emerging Discipline Rooted in a Long History

aging IC is complex and extensive and requires expertise and management attention. The new profession of KM specialists, from several academic fields, is becoming a

reality. As indicated in Figure 7, the disciplines and other areas that KM relies upon include:

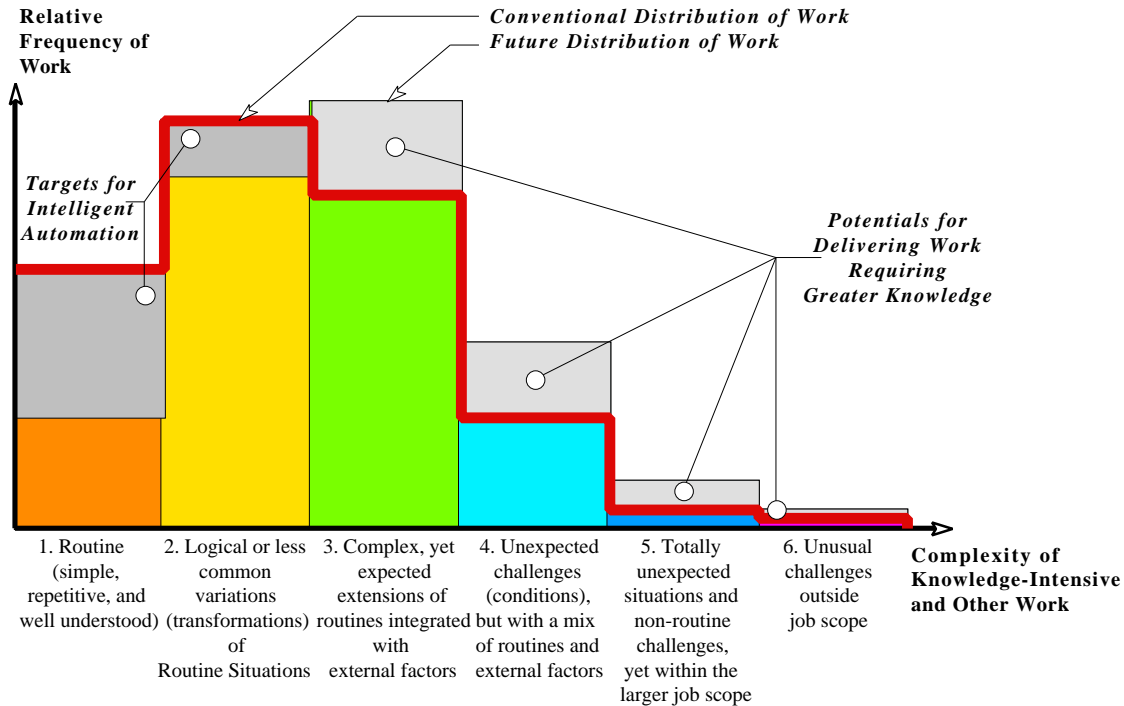


Figure 6. Changes Will Make Work More Complex.

Disciplines in Support of KM

- Business Theory & Economics to create strategies, determine priorities, and evaluate progress.
- Cognitive Sciences to understand how best to support knowledgeworkers' mental functioning required by their work settings.
- "Cybrary" Sciences to bring knowledge-related services to everyone.²⁴
- Ergonomics to create effective and acceptable work environments.
- Information Sciences to build supporting infrastructure and special knowledge-related capabilities.

- Knowledge Engineering to elicit and codify knowledge.
- AI to automate routine and assist knowledge-intensive work with reasoning and other high-level functions.
- Management Sciences to optimize operations and integrate KM efforts with other enterprise efforts.
- Social Sciences to provide KM-related motivations, people processes, and cultural environments.

General Principles for Effective KM

- Systematic and explicit KM to maximize the effectiveness of the enterprise business drivers.
- Knowledge-Based vision to provide the long-term basis for a broad KM practice.

²⁴ "Cybrarians" combine expertise from library science and cyberspace to obtain and organize information and knowledge.

Knowledge Management: An Emerging Discipline Rooted in a Long History

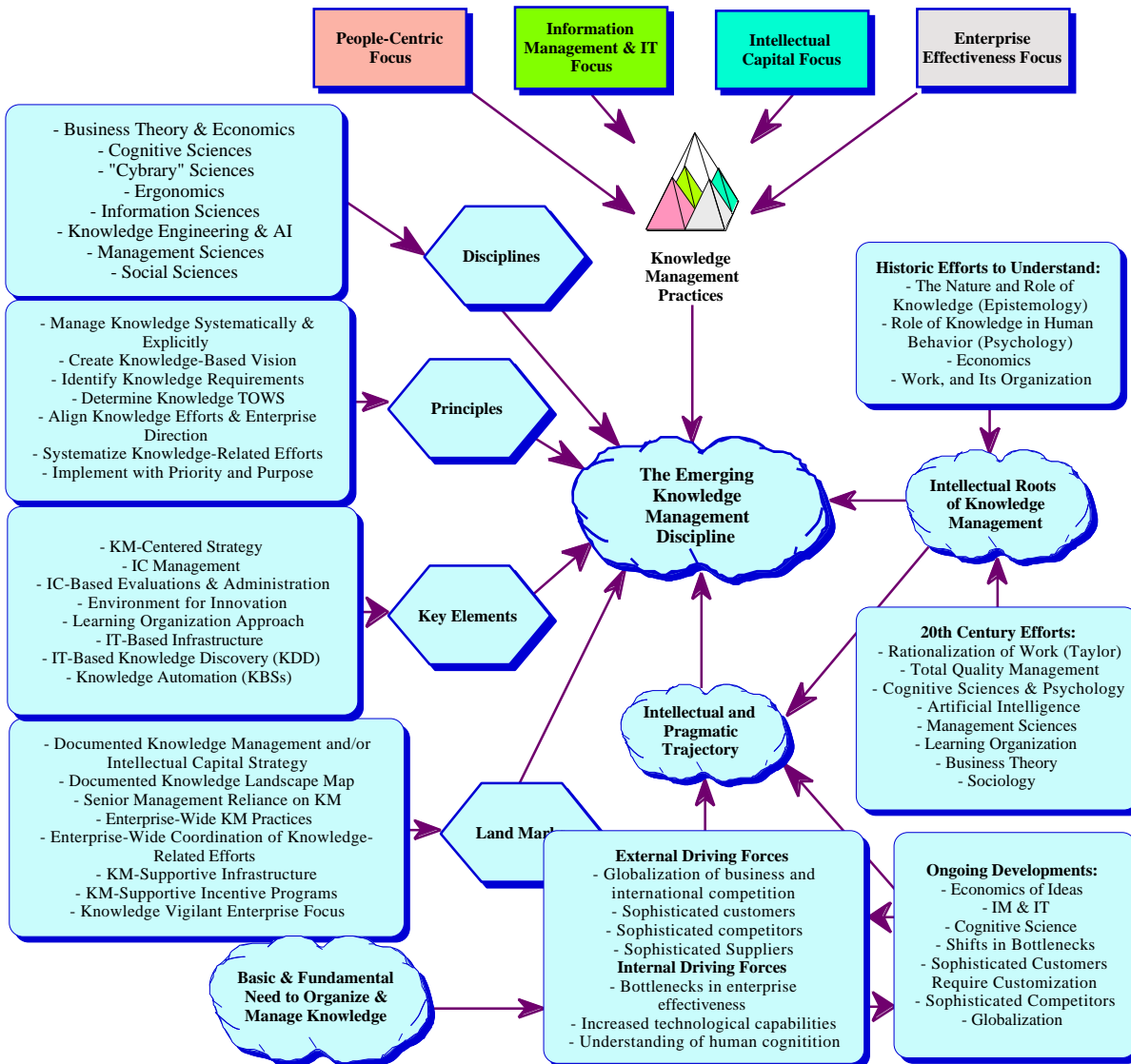


Figure 7. A Perspective of the Emerging Knowledge Management Discipline.

- Identification of knowledge requirements for individual functions to determine which knowledge to make available.
- Determination of Knowledge TOWS (Threats, Opportunities, Weaknesses, Strengths) to set priorities and develop needed KM tasks.
- Alignment of knowledge efforts & enterprise direction to realize the best value of the KM practice.
- Systematized knowledge-related efforts to make the KM practice effective.

- Implementation of KM with priority and purpose to minimize waste and maximize KM value.

Key Elements of KM Practices

- KM-Centered strategy to achieve effective, integrated KM practice and coordinate KM activities.
- Focused IC management to maximize overall value of building and exploiting IC.
- IC-Based evaluations and administration to optimize local IC investments, utilization, and caretaking.

Knowledge Management: An Emerging Discipline Rooted in a Long History

- Provision of environment for support of innovation to build competitive IC.
- Learning Organization Approach to build competitive knowledge faster than competition.
- IT-Based Infrastructure to provide effective support for KM.
- IT-Based Knowledge Discovery (KDD) to learn maximally from the past.
- Knowledge Automation (KBSs) to streamline operations.
- Enterprise-Wide Coordination of Knowledge-Related Efforts indicating sophistication of KM involvement.
- KM-Supportive Infrastructure indicating potential efficiency of KM practice.
- KM-Supportive Incentive Programs indicating realization that KM is people-centric.
- Knowledge Vigilance indicating reliance on knowledge and IC for success and viability.

Key Elements of KM Practices

- KM-Centered Strategy to drive towards effective, integrated KM practice and coordinate KM activities.
- IC Management to maximize overall value of building and exploiting IC.
- IC-Based Evaluations and Administration to optimize local IC investments, utilization, and caretaking.
- Provide Environment for Innovation to build competitive IC.
- Learning Organization Approach to build competitive knowledge faster than competition.
- IT-Based Infrastructure to provide effective support for KM.
- IT-Based Knowledge Discovery (KDD) to learn maximally from the past.
- Knowledge Automation (KBSs) to streamline operations.

Landmarks for Developing KM Practices

- Documented KM and/or Intellectual Capital Strategy indicating the extent and maturity of KM preparation.
- Documented Knowledge Landscape Map indicating understanding of knowledge TOWS.
- Senior Management Reliance on KM indicating enterprise commitment.
- Enterprise-Wide KM Practices indicating extent to which KM is pursued in practice.

Knowledge Management Must Justify Its Existence

Most organizations still pursue KM without ascertaining that hard business reasons require it. This is changing—and for good reasons. The premises are that competitive knowledge backed by deliberate KM are important for sustained success and viability and that the enterprise value largely comes from IC. It may therefore be irresponsible to pursue KM without having explicit understanding of how the efforts will be of value. There are several reasons for establishing the effects and benefits of potential KM actions. As the example in Figure 8 indicates, the immediate effects, followed by intermediate and final effects of the KM effort should be explicated for five major purposes:

- To support KM planning, decision making, and priority setting, and to obtain estimates of magnitude and timeframe of potential benefits, costs, and risks.
- To delineate the nature of expected and desired KM-related events and agree with stakeholders about suitable descriptions of expected events and their benefits or associated risks, and provide a graphical (visual) framework to support the collaborative KM planning process.

Knowledge Management: An Emerging Discipline Rooted in a Long History

- To enable the desired outcomes from KM efforts, delineate the various effects that are sought or expected with identification of ancillary activities that must be considered.
- To promote understanding of desired effects to support implementation over the life-time of the process by describing the events and associated characteristics.
- To monitor the KM-influenced event process to manage it appropriately,

and provide sufficient understanding of the anticipated events by outlining expectations over time in sufficient detail.

The proposed KM efforts—and later, KM implementation—need to be outlined in some detail to support these purposes.

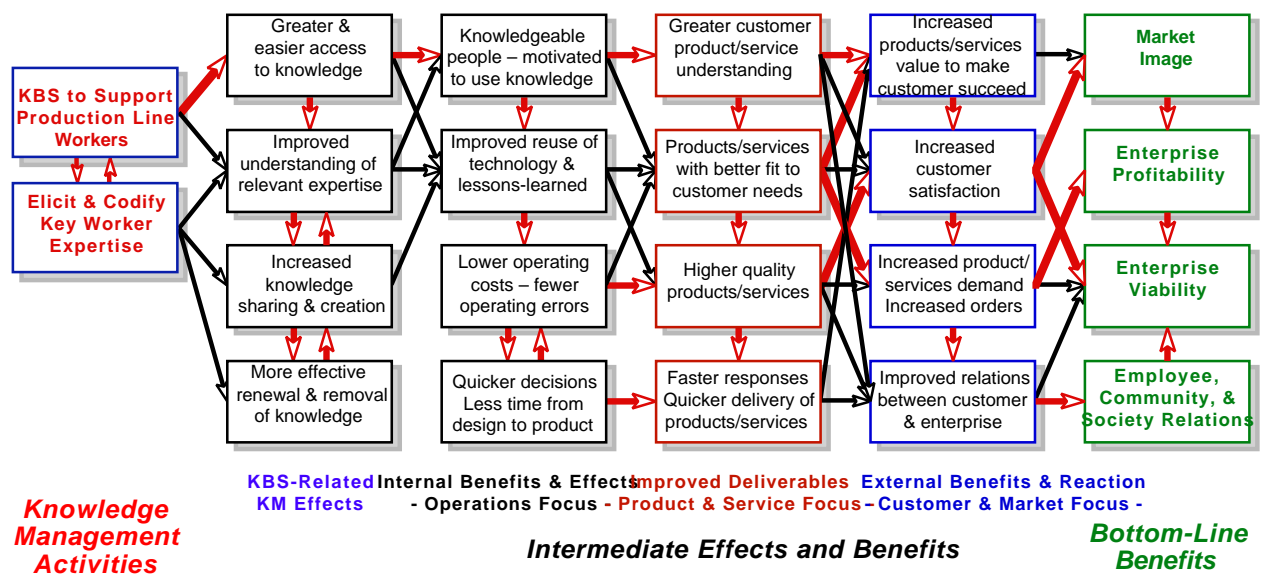


Figure 8. Knowledge Management Activities Are Expected to Progress through Internal and External Events to Deliver Bottom-Line Benefits.

Concluding Perspectives

KM will continue to evolve and draw upon support from many theoretical and methodological areas. For instance, cognitive sciences will increase understanding of decision making, cognitive support needed for work, effective learning, and skills transfer processes. Research on the nature of intellectual work will explicate how different kinds of knowledge is used, should be possessed, and accessed. Management sci-

ences will provide methods for managing IC renewal, priorities, and investments. AI and advanced information technology will increase abilities to supplant and support complex work tasks. New directions such as “Economics of Ideas,” “Economics of Chance,” and Chaos Theory will provide new perspectives and new guidelines for effective management in the knowledge society. New models for Theory of the Firm will elucidate new tactical values, principles, and judgments.

However, much needs to be done. We do not understand much about knowledge. Our understanding of the cognitive aspects of human functioning (as related to decision making and knowledge-intensive work) is marginal. There is not an accepted economic “theory of knowledge” that is applicable to business or daily life. We do not have a general understanding of how to undertake comprehensive and systematic KM within an organization. We may need an entirely new theory of the firm to manage knowledge effectively—and to link it properly with enterprise strategy, tactics, and daily operations—while recognizing that in most organizations people and their behaviors contribute much more to the enterprise success than the assets that conventionally are targets of management focus.

One key learning is that we must adopt greater people-centric perspectives of knowledge. To be viable, we need constant learning—led by constant innovation. Technology only goes so far. It can only provide us with rudimentary reasoning devoid of innovation and with concrete analyses of the past through approaches such as knowledge discovery in databases. People are the intelligent agents that create and act on new opportunities. It is those opportunities that will bring the world forward.

One doctrine of KM is the need to arrange our affairs to avoid rediscovering what earlier thinkers have created but maximize the reuse of valid knowledge and practices. We must adopt this tenet for our own work in KM.²⁵ General Colin Powell reminds us to “Not invent what is already

thriving!” Human history is not a history of cleverness and increasing acuity of vision. KM is not a result of people having become smarter, only more knowledgeable by building on powerful concepts inherited from prior generations.

References

- Austin, Robert D. (1996) **Measuring and Managing Performance in Organizations**. New York: Dorset House.
- Bechara, Antoine; Damasio, Hanna; Tranel, Daniel; & Damasio, Antonio R. (1997) “Deciding Advantageously Before Knowing the Advantageous Strategy.” **SCIENCE**, **275**, 1293-5.
- Boulding, Kenneth E (1966) “The Economics of Knowledge and the Knowledge of Economics.” **American Economic Review**, May, 1-13.
- Cannon-Bowers, Janis A. & Salas, Eduardo (1998). “Team Performance and Training in Complex Environments: Recent Findings from Applied Research.” **Current Directions in Psychological Research**, March 1999, pp. 83-87.
- Chandrasekaran, B.; Josephson, John R.; & Benjamins, V. Richard (1999). “What Are Ontologies, and Why Do We Need Them?” **IEEE Intelligent Systems**, **14**, 1, pp. 20-26.
- Cleveland, Harlan (1985) **The Knowledge Executive: Leadership in an information society**. New York: Truman Tally Books, E. P. Dutton.
- Drucker, Peter F. (1988) “Management and the World’s Work.” **Harvard Business Review**, **66**, September-October.
- Edvinsson, Leif & Malone, Michael S. (1997) **Intellectual Capital: Realizing your company’s true value by finding its hidden brainpower**. New York: Harper Business.
- Gardner, Howard (1983) **Frames of Mind: The theory of multiple intelligences**. New York: Basic Books.
- Gardner, Howard (1985) **The Mind’s New Science: A History of the Cognitive Revolution**. New York: Basic Books.

²⁵ David Owens, a long-time KM practitioner and academic, reminds us emphatically about this point

Knowledge Management: An Emerging Discipline Rooted in a Long History

- Hilmer, Frederick G. & Donaldson, Lex (1996) **Management Redeemed: Debunking the Fads that Undermine our Corporations**. New York: Free Press.
- Kao, John (1996). **JAMMING: The Art and Discipline of Business Creativity**. New York: Harper Business.
- Kelly, Kevin (1996). "The Economics of Ideas." **Wired**, 4 (6): 149
- Klein, Gary (1998) **Sources of Power: How people make decisions**. Cambridge: MIT Press.
- Kurtzman, Joel (1999). "An Interview with Howard Gardner." **Strategy & Business**, 14 First Quarter 1999, 90-99.
- Lakoff, George (1987) **Women, Fire, and Dangerous Things: What categories reveal about the mind**. Chicago: University of Chicago Press.
- Lucier, Charles E. & Torsilieri, Janet D. (1997). "Why Knowledge Programs Fail: A CEO's Guide to Managing Learning." **Strategy & Business**, Fourth Quarter 1997, (9): 14-28.
- Romer, Paul (1989). "What determines the Rate of Growth and Technological Change" **World Bank Working Papers, WPS 279**.
- Schank, Roger C., & Abelson, Robert (1977) **Scripts, Plans, Goals, and Understanding: An Inquiry into Human Knowledge Structures**. Hillsdale, NJ: Lawrence Erlbaum.
- Senge, Peter M. (1990). **The Fifth Discipline: The Art & Practice of the Learning Organization**. New York: Dobleday Currency.
- Simon, Herbert A. (1976). **Administrative Behavior: A Study of Decision-Making Processes in Administrative Organizations** (3rd Edition). New York: The Free Press.
- Stewart, T. A. (1991). "Brainpower." **Fortune**, 123 (11), June 3, 44-60.
- Stewart, T. A. (1997) **Intellectual Capital: The new wealth of organizations**. New York: Currency Doubleday.
- Suchman, Lucy (1995). "Making Work Visible." **Communications of the ACM**, 38 (9): 56-65.
- Sveiby, Karl Erik (1997) **The New Organizational Wealth: Managing & measuring knowledge-based assets**. San Francisco: Berrett-Koehler
- Sveiby, Karl Erik, & Lloyd, Tom (1987). **Managing Knowhow**. London, England: Bloomsbury.
- Wiig, Elisabeth H. & Wiig, Karl M. (1999). **On Conceptual Learning. KRI Working Paper 1999-1**. Arlington, TX: Knowledge Research Institute, Inc.
- Wiig, Karl M. (1993). **Knowledge Management Foundations: Thinking about Thinking-How People and Organizations Create, Represent, and Use Knowledge**. Arlington, TX: Schema Press.
- Wiig, Karl M. (1995). **Knowledge Management Methods: Practical Approaches to Managing Knowledge**, Arlington, TX: Schema Press.
- Wiig, Karl M. (1997). "Knowledge Management: Where did it come from and where will it go?" **Expert Systems with Applications**, 13, 1, 1-14.
- Winograd, Terry (1988). **Byte**, 13, 11, December 1988, p. 256.

Knowledge Management: An Emerging Discipline Rooted in a Long History