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Knowledge Management: Where Did It Come From and Where Will It Go?

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Abstract—*Knowledge management came for some as the proverbial bolt from the blue. This paper traces the history of knowledge management from its modest beginnings in the early/mid eighties to its current status. It shows that knowledge management is, to a certain extent, the logical next step in a sequence of societal developments that has already been going on for a very long time. The likely future of knowledge management is explored along four perspectives: The management practices perspective, the information technology perspective, the organizational efforts perspective and the development, supply and adoption rate perspective. The conclusion is that knowledge management methods and technologies will, until the turn of the century, be provided in a 'technology push' manner. After that time a more 'demand pull' way is foreseen. For the average company the full operation period will probably be in the first quarter of the next century. And, as will happen with every new approach, it will become outdated somewhere in the second quarter of the next century.* © *1997 Elsevier Science Ltd*

1. INTRODUCTION

INCREASINGLY, LEADERS OF progressive organizations—and nations such as Singapore—pursue active ways to create and derive value from knowledge assets within their organizations. Often, these efforts are spurred by personal beliefs and strong convictions that competitive knowledge assets and their effective utilization are critical for success. Less frequently, efforts are supported by careful analyses and well-founded theories. In fact, the explicit focus on knowledge is so recent that business practitioners still lead the quest to explore and implement approaches to manage knowledge. There is still little significant support from academic and management research except in specialized technical areas such as applied artificial intelligence and the use of information technology. To date, no general approach to managing knowledge has been commonly accepted—although several isolated, and at times diverging, notions are being advanced. One notion deals with management of explicit knowledge using technical approaches. It primarily focuses on knowledge acquired from people, in computer knowledge bases, knowledge-based systems, and knowledge made available over technology-based networks using e-mail, groupware, and other tools[1]. A second notion focuses on management of 'intellectual capital' in the forms of structural capital and human capital in people[2]. A third notion for managing knowledge, pursued in this chapter, has a broader focus to include all relevant knowledge-related aspects that affect the enterprise's viability and success. It encompasses the above notions to also include most other knowledge-related practices and activities of the enterprise[3].

Systematic management of knowledge takes on new importance with the current economic reality where knowledge is a differentiating competitive factor for individuals, corporations, and nations. This reality is the driving force behind broad adoption and continued development of powerful methods and tools to manage knowledge.

2. KNOWLEDGE MANAGEMENT: A WORKING DEFINITION

Simply stated, in the opinion of this author, the objectives of knowledge management (KM) are:

(1) To make the enterprise act as intelligently as possible to secure its viability and overall success and
(2) To otherwise realize the best value of its knowledge assets.

[1] This approach was pursued by Digital Equipment Corporation. Also, see Feigenbaum and McCorduck (1983), Feigenbaum et al. (1988) and Hertz (1988).

[2] Intellectual Capital Management (ICM) is led by Skandia, the Swedish insurance company, and explained in the supplements to their 1994 and 1995 Annual Reports (see also Wilkins et al., 1997 and Stewart, 1997).

[3] Comprehensive KM has been described by Wiig (1994) and in greater detail in Wiig (1993, 1995).

To reach these goals, advanced organizations build, transform, organize, deploy, and use knowledge assets effectively. In other words, the overall purpose of KM is to maximize the enterprise's knowledge-related effectiveness and returns from its knowledge assets and to renew them constantly. KM is to understand, focus on, and manage systematic, explicit, and deliberate knowledge building, renewal, and application—that is, manage effective knowledge processes (EKP). In a 1989 survey, several Fortune 50 CEOs agreed that knowledge is a fundamental factor behind all the enterprise's activities. They also agreed that enterprise viability hinges directly on the competitive quality of knowledge asset and their successful application to create and deliver products and services[4].

Another notion is that the 'body of knowledge' within the enterprise is comparable to a living organism with all its flows and functions that energize, motivate, and revitalize the enterprise and make it possible for it to function. Its health directly affects our ability to operate effectively and to compete. This makes it possible for everyone to 'act intelligently' as required. It is the role of knowledge management to keep the body of knowledge alive and vibrant to secure the enterprise's well-being and long-term viability.

As straightforward as these notions are, to achieve these goals in practice—across all the enterprise's activity areas—is far from easy. It becomes even more complex when management decides to systematically integrate and manage the important KM-related activities. Each enterprise tends to be unique and options for managing knowledge are legion. Furthermore, since KM is still relatively new, the availability of standardized or off-the-shelf approaches is limited. Consequently, customized approaches are often devised to provide the enterprise with the best and most applicable solutions and this adds to the complexity. Nevertheless, well-established strategies, practice models, and technical options are now becoming available to alleviate the difficulty of pursuing KM once management steers the focus is in that direction.

From a managerial perspective systematic KM comprises four areas of emphasis. They focus on:

(1) Top–down monitoring and facilitation of knowledge-related activities;
(2) Creation and maintenance of knowledge infrastructure;
(3) Renewing, organizing, and transferring knowledge assets; and
(4) Leveraging (using) knowledge assets to realize their value.

These areas are shown in Fig. 1 which also indicates some relevant knowledge-related practices and activities.

3. KNOWLEDGE MANAGEMENT AS A DISCIPLINE

Knowledge management (KM) has only recently emerged as an explicit area of pursuit for managing organizations—and even more recently as a topic of serious study or academic knowledge transfer. Clearly, knowledge has been managed implicitly as long as people have thought seriously about their work. The first hunters surely were concerned about the expertise and skills of their team mates when they went out to capture prey. They also, we must surmise, ascertained that what they knew as the best and most successful practices were taught to up-and-coming hunters to ensure the long-term viability of the group. From very early times, wise people have secured sustained succession by transferring in-depth knowledge to the next generation.

Elders within universities and other learning institutions have been concerned about knowledge transfer processes and the creation and application of knowledge for several millennia. Early on, Indian mathematicians built upon generations of knowledge to develop mathematics that is quite sophisticated even by today's standards. Phoenicians were implicitly concerned about how knowledge about trade logistics and merchant practices was built, transferred to employees, and applied to make operations as successful as possible. Nevertheless, systematic KM for business purposes, as we understand it today, did not become explicit until about a decade ago and even today it is not a commonly shared concept among managers.

4. AN ECONOMIC MODEL AND A STRATEGY MODEL TO LIGHT THE WAY

A few economists, led by Paul Romer, have made us understand about 'economics of ideas' and the almost unlimited potentials for economic growth and success that new innovations and knowledge-based products make possible (Romer, 1993; Kelly, 1996)[5]. This model diverges sharply from more traditional economic perspectives which presume restricted expansion opportunities based on scarcity of physical resources, available labor, capital, etc. In contrast to earlier theories, the economics of ideas explains much of the increased quality of life and wealth creation of the last decades and goes beyond the notion that improved 'technology' is the factor behind the observed growth. It points squarely to the vital role that knowledge plays. Making people knowledgeable brings innovation and continued ability to create and deliver products and services of the highest

[4] Reported by Wiig (1994, pp. 37–61).

[5] See also the Internet World Wide Web: <http://www.wired.com/4.06/romer/>.

quality. It also requires effective knowledge capture, reuse, and building upon prior knowledge.

In our context, Romer's model for the economics of ideas clearly indicates some of the economic perspectives and motivations behind the progressive manager's desire to focus on knowledge-dependent opportunities and strategies. The model also explains why organizations that do not pursue knowledge-dependent strategies have problems. Their products, services, and internal operations become limited compared to innovative organizations.

Individual organizations focus on different areas to conduct their business. This reflects their strengths, the nature of their business, and the inclinations and expertise of their personnel. In practice, we find that most enterprises pursue one or more of the following knowledge management strategies:

- *Knowledge Strategy as Business Strategy* **Focus:** Emphasize knowledge creation, capture, organization, renewal, sharing, and use in all the enterprise's plans, operations, and detailed activities to have the best possible knowledge available—and used—at each point of action.
- *Intellectual Asset Management Strategy* **Focus:** Emphasize enterprise-level management of specific intellectual assets such as patents, technologies, operational and management practices, customer relations, organizational arrangements, and other structural knowledge assets. Management may center on renewing, organizing, valuating, safekeeping, as well as increasing the availability and marketing of these assets.
- *Personal Knowledge Asset Responsibility Strategy* **Focus:** Emphasize personal responsibility for knowledge-related investments, innovations, and the competitive state, renewal, effective use, and availability to others of the knowledge assets within each employee's area of accountability to being able to apply the most competitive knowledge to the enterprise's work.
- *Knowledge Creation Strategy* **Focus:** Emphasize organizational learning, basic and applied research and development, and motivation of employees to innovate and capture lessons learned to obtain new and better knowledge that will lead to improved competitiveness.
- *Knowledge Transfer Strategy* **Focus:** Emphasize systematic approaches to transfer—obtain, organize, restructure, warehouse or memorize, repackage for

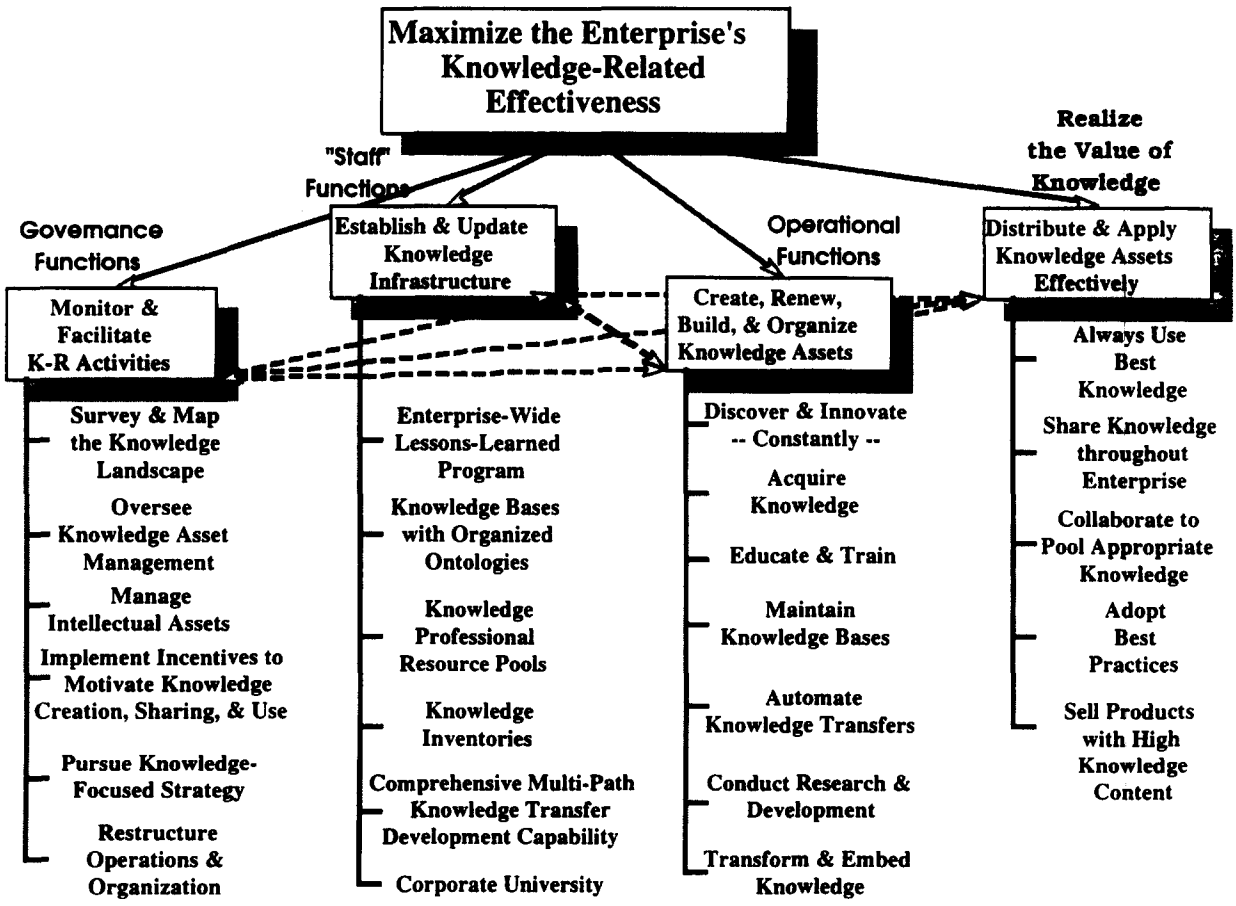

FIGURE 1. Four areas of knowledge management emphasis [adapted with permission from Wiig (1995)].

deployment, and distribute—knowledge to points of action where it will be used to perform work. Includes knowledge sharing and adopting best practices.

The fundamental strategies pursued by leading enterprises provide important perspectives on the driving forces behind the evolution from early agrarian societies to today's knowledge-dependent situation. The value discipline model advanced by Treacy and Wiersema is particularly helpful for understanding recent changes in strategy focus from the industrial revolution to the knowledge society. Their model posits that highly successful enterprises have value disciplines that focus on either operational excellence, product leadership, or customer intimacy. They suggest that only outstanding organizations can pursue more than one of these value disciplines which they define as (Treacy & Wiersema, 1993):

- *Operational Excellence* **Focus:** Emphasize industry leadership in price and customer convenience by minimizing overhead costs, eliminating intermediate production steps, reducing transaction and other 'friction' costs, and optimizing business processes.
- *Product Leadership* **Focus:** Emphasize creation of a continuous stream of state-of-the-art products and services by being creative, commercializing ideas quickly, and relentlessly pursuing new solutions, often by obsolescing their own products.
- *Customer Intimacy* **Focus:** Emphasize continual tailoring and shaping products and services to fit an increasingly better definition of the customer's needs to personalize offerings to make the customer successful.

The choice of which KM strategy to pursue is typically based on other strategic thrusts and the value discipline that the enterprise pursues, challenges it faces, and opportunities it wishes to act upon.

5. AN EVOLUTIONARY PERSPECTIVE OF KNOWLEDGE MANAGEMENT

We can use Treacy and Wiersema's model to illustrate how the world has increased its reliance on knowledge by observing how the economic focus has shifted over time. Early on, the focus was on concerns with how to make the most with limited resources (by pursuing operational excellence). Later, the focus shifted to making clever products (by pursuing product leadership). Presently, advanced organizations focus on creating ingenious solutions and developing broad relationships to make customers succeed in their business (by pursuing customer intimacy).

Arguably, the present emphasis on knowledge management (KM) has resulted naturally from the economic, industrial, and cultural developments that have taken place. In the opinion of many management pundits, we have already entered into the 'knowledge society'. This notion is based on the new emphasis and explicit dependence on adding competitive value to products and services by application of direct or embedded human expertise-knowledge. This is a considerable change from providing value by relying on natural resources or operational efficiency as was the case in previous eras[6].

Given this framework, we can construct a perspective of the evolution that has led to today's importance of KM. Historic developments may be portrayed by the following descriptive stages of dominant economic activities and foci:

- *Agrarian Economies.* The economic stage after hunting and gathering led to agrarian societies that focused on creating food supplies by raising crops and domesticating animals. The role of people was to provide physical labor for animal husbandry, working the soil, planting, and harvesting. Knowledge *per se* was not generally recognized. Success and viability were to a large extent determined by farming skills. **Focus:** Agriculture.
- *Natural Resource Economies.* Historically, market advantages were created by providing products by exploiting natural resources—minerals, agricultural commodities, etc. The role of people was to facilitate conversion of resources to saleable goods and to bring them to markets, mostly by performing the physical work required. Additionally, small groups of expert tradesmen (masons, blacksmiths, tailors, etc.) would provide highly personalized services. Knowledge started to be recognized, in part within the guilds and its masters. **Focus:** Natural Resource Exploitation Dominate while Customer Intimacy was Pursued Separately by Expert Tradesmen and Guilds.
- *Industrial Revolution.* During the 18th and 19th centuries conversion of natural resources and manufacturing of products were increasingly better organized and mechanized to improve the efficiency of the processes. Market advantages for enterprises—and for countries—were created by being able to use people and technology to provide goods and services at acceptable quality and at affordable or lowest price. Operationally, that often meant having individual workers produce as much goods as possible using highly standardized routines. Knowledge was recognized but only among the guilds and other specialists. **New focus:** Operational Excellence through Efficiency.
- *Product Revolution.* During the first half of the 20th century a new dimension was added to the focus. Initially, manufacturers provided greater product variability (the Model T Ford versus Oldsmobile)—

[6] See Böhme and Stehr (1986), Cleveland (1985), Drucker (1993) and Amidon (1997) for further discussions of the knowledge society.

produced at the lowest possible cost. Later, additional emphasis started to be placed on product sophistication. Furthermore, the concept of services to complement products started to emerge. The notion of 'improved products' that served their purpose better were increasingly accepted. Market advantages were based on having products that would fit a particular market niche both functionally and economically. The roles of professionals and craftspeople were changing to where expertise, particularly in the form of skills, was becoming important. Recognition of the value of broad individual knowledge had not changed from the industrial era and was still not explicit. **New focus:** Product Leadership through Variability and Sophistication.

- *Information Revolution.* During the second half of the 20th century the combined focus of operational excellence and product leadership continued. Market advantages were still based on ability to deliver the most applicable products and services at the best price. Information technology (IT) became available and resulted in closer control of manufacturing, logistics, and marketing. These developments led to extensive information gathering and exchanges between enterprises, their suppliers, and customers. They made possible many important practices such as total quality management (TQM), just-in-time (JIT) deliveries, point-of-sale (POS) analysis, and automatic process control. IT also made possible new services not previously possible ranging from financial services (credit card operations, for example) to telecommunications services. Roles of people were gradually changed from physical work in production (manufacturing) to 'desk work' in service (often clerical). The real nature of mental work performed in this new environment was still not well understood or appreciated. **Continued focus:** Operational Excellence and Product Leadership.
- *Knowledge Revolution.* During the last decade influential business pundits have observed that the real basis for competition has started to shift. In particular, it has shifted towards how well knowledge and other intellectual assets are brought to bear to make the enterprise's customers successful. This realization has led many organizations to pursue strategies to actively and explicitly manage knowledge. They need to ascertain that they obtain, renew, and use the best possible knowledge in all areas of work. They must also continue to embed it in products, services, and their internal operations. In addition to controlling costs and creating innovative products and services, market advantages are now based on how best to serve individual customers to help them succeed. This change has necessitated that organizations work very closely with their customers to understand their businesses and their environments. The role of people has also changed. Leading organizations see that their employees, instead of being a replaceable commodity, is the fundamental capability behind their whole existence and success—the source of profitability and the driver for sustained viability. The versatility and intelligent behavior of knowledgeable people become the power and drivers that make it possible to meet the wide range of individual customer requirements that the sophisticated, modem market demands. **New focus:** Customer Intimacy.

The need to focus on managing knowledge within the enterprise results from both economic and market-driven requirements created by customer demands and international competition. During the last decades, customers have become increasingly discriminating. They demand products and services that fulfill their particular needs more precisely and to greater advantage. It often is not enough to provide generic or commodity products—however sophisticated. Customers—individual consumers and industrial companies alike—require products and services that will make them more successful in their own pursuits and provide them with the best possible advantages. At the same time as customer sophistication has increased, education and skills of craftspeople and professionals all over the world have risen. Many former 'developing nations' can now compete with advanced industrial nations in engineering, computer software creation, advanced consumer product design, and expert customer service for high-technology products, just to name a few. Competition for who can provide the best products and services based on relevant knowledge has truly become international.

Advanced companies in the Americas and Europe are well aware of the needs to manage knowledge—and to do it systematically and comprehensively. However, the present KM practices are only emerging at this time and most practitioners, of necessity, focus on relatively narrow application areas. This is expected to continue until the availability of good KM methods and practices become more common. Nevertheless, companies that have pursued KM for some time are able to point to considerable tangible and intangible benefits. The advantages of deliberate KM are also made apparent by their leadership positions within their industries and markets.

Explicit and systematic management of knowledge has emerged naturally as a result of several developments. After WW II, socioeconomic and business environments led to changes in the demand for knowledge-based products and services. In the late 1950s, emergence of information technology (IT) led to the first steps to automating intelligent behavior by artificial intelligence (AI)—as research but also for economic gains. In the 1960s our understanding of business operations, in the forms of operations research (OR) and management sciences, strategic planning, and applied cybernetics and 'systems thinking' became better established. This allowed us to think of 'business processes'

and their interactions, internal operations, and dynamic characteristics in ways not done earlier. Our understanding of how people think and reason has also gradually improved over the years but was brought forward by cognitive sciences work in the 1970s and subsequent years. Lastly, our understanding of knowledge-based organizational behaviors such as individual and group decision making were elucidated in the 1980s [see, for example, Simon (1976), Janis (1989), and Janis and Mann (1977)].

6. KNOWLEDGE MANAGEMENT COMES OUT OF THE CLOSET—A 20 YEAR TIME-LINE

All of these developments—changing markets and business foci and increased understandings—came together to make it possible for us to consider how knowledge might be managed effectively and systematically in support of enterprise objectives. The foundation for 'Knowledge Management' was established and it became a natural basis for the concept to emerge in many organizations and in different disguises. Accordingly, some examples of KM-related developments that have taken place over the last two decades can be listed[7]:

6.1. 1975

As one of the first organizations to explicitly adopt a knowledge-focused management practice, Chaparral Steel bases their internal organizational structure and corporate strategy to rely directly on explicit management of knowledge to secure technical and market leadership—without the assistance of information technology. Chaparral still does not rely much on IT for its extensive KM practice and remains the quality and efficiency world-leader among mini-mills.

6.2. 1980

Digital Equipment Corporation (DEC) installs the first large-scale knowledge-based system (XCON) for support of its configuration engineering and sales functions.

6.3. 1981

Arthur D. Little starts the Applied Artificial Intelligence Center to build practical knowledge-based systems (KBS) for commercial and Government clients.

6.4. 1983

USAA develops the first version of a KBS to transfer expert knowledge to practitioners as part of their deliberate effort to manage knowledge.

6.5. 1986

The concept of 'Management of Knowledge: Perspectives of a new opportunity' is introduced in a keynote address at a European management conference sponsored by the International Labour Organisation of the United Nations.

6.6. 1987

The first book relating to KM is published in Europe (Sveiby & Lloyd, 1987).

6.7. 1987

The first roundtable KM conference 'Knowledge Assets into the 21st Century' hosted by DEC and Technology Transfer Society at Purdue University.

6.8. 1989

A survey of Fortune 50 CEOs' perspectives on KM is undertaken in which all agree that knowledge is their organization's most important asset—but no one knows how to manage it.

6.9. 1989

The Sloan Management Review publishes its first KM-related article (Stata, 1989).

6.10. 1989

Several management consulting firms start internal efforts to manage knowledge. (Price Waterhouse integrates KM into its strategy.)

6.11. 1989

A few small and specialized consulting firms offer KM-specific services to clients.

6.12. 1989

The International Knowledge Management Network is started in Europe.

6.13. 1990

The Initiative for Managing Knowledge Assets (IMKA) is started by a consortium of several US companies to provide a technological base for KM.

6.14. 1990

In Europe the first book on the learning organization is published (Garratt, 1990).

6.15. 1990

In the US the first books relating to KM are published (Savage, 1990; Senge, 1990).

[7] This listing reflects the author's limited insights and is clearly incomplete. Some additions have been provided by Amidon (1996), Demarest (1996), and Wilson (1996).

6.16. 1990

The French Grande Colloquium de Perspective provides major address on 'Knowledge Flow in a Global Innovation Management System'.

6.17. 1991

Skandia Insurance creates the position of Director of Intellectual Capital.

6.18. 1991

The first Japanese book relating to KM is published in the US (Sakaiya, 1991).

6.19. 1991

Fortune runs the first article on KM (Stewart, 1991).

6.20. 1991

Harvard Business Review runs its first article on KM (Nonaka, 1991; Nonaka & Takeguchi, 1995).

6.21. 1992

Steelcase and EDS cosponsor conference on Knowledge Productivity.

6.22. 1993

In Europe, an important KM article is published (Steels, 1993).

6.23. 1993

The first book explicitly dedicated to KM is published (Wiig, 1993).

6.24. 1994

The International Knowledge Management Network expands its scope to include the Internet.

6.25. 1994

The International Knowledge Management Network publishes a KM survey of 80 Dutch companies (Spijkervet & van der Spek, 1994).

6.26. 1994

The International Knowledge Management Network conducts a conference 'Knowledge Management for Executives' with over 100 European participants in Rotterdam. Université de Technologie de Compiègne (France) holds its first annual KM conference.

6.27. 1994

Several large consulting firms offer KM services and start seminars for prospective clients on KM.

6.28. 1994

Knowledge Management Network and FAST Company magazine are founded in the US.

6.29. 1995

The European ESPRIT program includes explicit requests for KM-related projects.

6.30. 1995

American Productivity and Quality Center (APQC) and Arthur Andersen conduct the *Knowledge Imperatives Symposium* with over 300 attendees. Other KM conferences and seminars are held in the US and Europe.

6.31. 1995

APQC initiates a multiclient KM Consortium Benchmarking Study with 20 sponsors.

6.32. 1995

The Knowledge Management Forum is started on the Internet.

6.33. 1995

KM Focus is broadened to include research on intellectual work (Suchman, 1995).

6.34. 1996

Several KM conferences and seminars are held in Europe and the US organized by both general conference organizers and consulting organizations.

6.35. 1996

Over one dozen large consulting organizations and many smaller ones offer KM services to clients.

6.36. 1996

Many companies are starting KM efforts—some with internal resources only, others with assistance by outside organizations.

6.37. 1996

The European Knowledge Management Association is started.

Given these events, it seems clear that KM has attained a considerable—but still narrow—momentum. Most organizations either have not yet heard about KM or have decided to wait before they start pursuing explicit knowledge-based practices. Of a number of arbitrarily selected CEOs that were contacted, only about half had heard of KM and only a few of their assistants had any understanding of what might be involved in managing knowledge. We ascribe this condition to the

sparsity of information on KM practices, experiences, role models, and general concerns.

7. WHERE MIGHT KNOWLEDGE MANAGEMENT BE HEADED?

When considering the future roles and importance of KM, we should look at potential developments from several perspectives. One perspective deals with the degree to which KM will continue to be a distinct management initiative. Associated with this perspective are the objectives and expectations for making better knowledge available—by innovations, importation of knowledge, research, and different transformation of 'raw' knowledge for deployment and further use—and various ways of exploiting it by embedding it in products and services, using it in daily work, or selling it outright as part of patents or licenses. A second perspective deals with the nature and intensity of efforts and the overall scope that will be undertaken to manage knowledge. A third perspective is related to the speed of evolution of KM methods and practices, and particularly the interplay between different KM contributors and practitioners. A somewhat similar perspective deals with availability and sophistication of KM tools and technological infrastructure. A further consideration deals with the overall aspects of how knowledge in its diverse forms, the intellectual assets, will be managed from the enterprise point of view. This consideration deals with how the enterprise will incorporate knowledge-related perspectives in its strategy setting and overall operations.

Given general business experiences, it is possible to illustrate how a typical company may progress to ultimately pursue active KM. The scenario in Table 1 indicates how a hypothetical organization may evolve as it proceeds from earlier management initiatives to adopting KM. The scenario also provides a projection of possible future directions of KM.

7.1. The Future of KM from the Management Practices Perspective

Similarly to what happens to other management directions that prove vital to enterprise viability, we can expect that KM—as an explicit and primarily stand-alone management initiative—will disappear from view within a decade or two. Instead, we can expect to find that what we today think of as explicit KM practices and activities, will have been assimilated into the daily mainstream work—they will become automatic and 'second nature'. Furthermore, as already has started to happen in companies like Dow Chemical, KM will be considered as a steppingstone to 'value management' or similar strategic directions. It will be extensively integrated with other practices and cease to exist as a separate entity. Many practices will all be part of a normal day's work and may be expected of employees at all levels. They include knowledge sharing, team work, and collaboration; always ascertaining that the best knowledge and practices are used; capturing and organizing research results, innovations, and lessons learned; and continually renewing knowledge wherever and in whatever manifestation it is found.

Many organizations will expect that each employee will take on personal responsibility for their continued development—for their personal knowledge building. Employees need to qualify for their work and such conditions can be found as part of contracts that secure their employment. This has already happened in several advanced enterprises in the US, particularly, the insurance company USAA. In these enterprises, we can see that KM has become a critical success factor, and it is closely intertwined with the business, professional, and managerial activities and functions and is no longer explicit. We can expect that this trend will be a common development for KM.

An aspect of great interest is the gradually emerging restructuring of organizational arrangements and the reorganization of work that result from advanced KM practices. One example is the combined introduction of practices to increase interaction opportunities for improved knowledge creation and 'slack'. Slack provides permission and time to allow employees to network in different ways. They can 'meet at the water cooler' to ask for input (advice), reflect on what they do and how they approach it, explore alternatives, etc. Opportunities for increased interactions are found to be very valuable since many—if not most—significant innovations are results of impromptu improvisations, chance meetings, and other serendipity situations. Descriptions of underlying mechanisms behind this trend are provided by Kao[8].

Another example of work place reorganization is the research and internal changes by Steelcase Inc. Steelcase has identified needs for new work place arrangements and interaction patterns to support effective work practices and KM. These are required to create *ad-hoc* teams and collaboration, support innovation, and provide for creative opportunities. As a result, Steelcase has restructured its own offices to allow increased interactions—and at the same time provide opportunities for people to cloister themselves for quiet periods. Their experiences are very positive and include reduced time to market, noticeably better innovations, and improved personal productivity (Miller, 1996).

7.2. The Future of KM from the Information Technology Perspective

Over the next few years we can expect drastic changes in our reliance on information technology (IT). In 1997, we

[8] Kao (1996) compares creative and effective implementation of strategy by executing myriads of impromptu 'decisions-in-the-small' improvisations with the processes of jazz jam sessions.

mostly see use of IT for support of KM in the form of passive infrastructure functions. They include local area networks (LANs), use of intranets, Internet and the World-Wide-Web (WWW), e-mail, rudimentary groupware applications, and corporate memory data bases. The latter have been aptly described as often being 'knowledge junkyards' (Demarest, 1996) due to our inability to obtain relevant information from them when needed. To a smaller extent, we see use of multi-media educational systems, knowledge-based system (KBS) applications. In a few instances we find KBS for knowledge deployment and prompting systems for knowledge

TABLE 1
Anderson Sprocket Manufacturing Inc. (ASMI) Evolves from Rudimentary TQM Practice to Enterprise-Wide Knowledge Management Practice over 25 Years

Year	ASMI's Knowledge Management and Business States
1985	ASMI starts to introduce total quality management (TQM) to improve product quality, motivate its work force, and increase market penetration.
1992	After 6 years, TQM results—aided by IT-based flexible manufacturing, JIT service, and time-to-market focus—are clearly positive. Considerable investments are made in educating all personnel and by changing to team organization. TQM is transferred from central staff to operating departments.
1993	Competitors are also improving and continue to pressure ASMI whose focus is still 'Operational Excellence' and its management pursues business process reengineering (BPR) to obtain further effectiveness advantages.
1995	ASMI is still only holding its competitive position—What should be done? ASMI has pursued Learning Organization without making a central effort with only modest success.
1996	ASMI learns about Knowledge Management (KM) and due to its serious business situation makes KM its central effort. It identifies its 'service paradigm', the 'knowledge landscape', KM priorities, required infrastructure, and needed incentives for a 5 year program. BPR had retired needed experts, crucial knowledge flows were missing, many morale problems were knowledge-related. To correct matters, a systematic 'Knowledge Transfer Strategy' is part of the KM program and ASMI starts to pursue 'Product Leadership' value discipline. The KM program first addresses the needs of marketing and sales to bring more knowledge to the customer interface for better product definitions and more complete customer service.
1999	New KM activities are added to support specific business needs and as earlier, general infrastructure capabilities are implemented when needed to support the different KM functions. Collaboration, knowledge sharing, and locating prior knowledge are aided by a new and sophisticated intranet implementation complemented by state-of-the-art application software. Employees feel motivated to be innovative given the new incentives. Knowledge reuse is beginning to be increased through knowledge discovery in existing data bases (KDD). Best practices are commonly adopted helped by fuzzy case based reasoning (CBR) methods. ASMI remains focused on 'Product Leadership' and 'Knowledge Transfer Strategy' led by CKO[a]. Customer relations and business improve in ways that often are directly attributable to KM.
2004	ASMI's business continues to improve. To support increasing business requirements, a comprehensive infrastructure is implemented to capture, transform, organize, and renew valuable knowledge. Librarians and IT specialists support other knowledge professionals. Most knowledge-related functions are coordinated by a 'Knowledge Transfer Council' led by the CKO. The change to make 'Knowledge Is Everybody's Business' is initiated. Advanced IT supports many KM functions. Advanced natural language understanding (NLU) provides extensive support to manage communications of all kinds, knowledge reuse is further increased through advanced knowledge discovery in existing data bases, etc. As people become better qualified to accept greater responsibilities for more complete work, decision authorities are pushed outwards. Changes are introduced to make the organizational structure facilitate more interactions, creativity, and collaboration while increasing effectiveness.
2010	Most KM-related functions are completely internalized into daily operations and have become 'second nature'. ASMI pursues 'Knowledge Strategy as Business Strategy' and 'Customer Intimacy' value discipline. Management implements their 'Enterprise Monitoring System' to direct attention and resources to keep ahead of competition. Numerous approaches are used to motivate employees and promote positive enterprise culture. The workplace has been completely redesigned to facilitate collaboration (including different-place–different-time telecommuting). These changes have increased creativity and effectiveness. Infrastructure relies on advanced IT to exploit the vast increases in personal computer speed and capacity to provide automated knowledge processing (for communications, improving reuse of knowledge for new applications, and automating many decision processes), personal assistants, and visualization of complex situations.

[a] CKO: Chief Knowledge Officer.

capture, for example in 'Lessons Learned' situations. Overall, we now see much greater involvement of IT for support of KM. In the past, both availability of appropriate software models and the computer capability have been limiting factors.

The limiting factors can be expected to change over the next years. We are in the middle of extensive changes in our understanding of how people work with their minds and how we can support and complement knowledge workers with advanced IT. Likewise, we see advances and breakthroughs in intelligent software that promise to support, enhance, and even automate many KM functions and assist in discovering and building knowledge.

Already, the power of personal computers exceeds the 1980 supercomputers and, according to industry experts, we can expect personal computing speeds and capacities to increase again by a factor of 500 by the year 2010[9]. Such computer capabilities make possible highly sophisticated applications. They will include automatic knowledge discovery in data bases (KDD), natural language processing for perspective-specific summarizing and abstracting communications of all types, intelligent agents on intranets and the WWW to discover opportunities and threats, automation of complex—but semi-routine—decision processes, visualization of complex situations and contexts, and applications not yet conceptualized such as personal assistants with wide access to information and with matching or complementary objectives, insights, and perspectives to advise and guide individual persons.

Given these advances, we must expect considerable changes in the role that advanced IT will play in effective KM. As a result, we can look forward to substantial improvements in the levels of intelligent-acting behavior of both individuals and organizations over the next decade. It is clear that these capabilities will change the way people work and require new knowledge requirements.

7.3. The Future of KM from the Organizational Efforts Perspective

Enterprises increase KM efforts and expand KM scopes as they gain greater insights into how to manage knowledge and how KM increases the value of competitively applied knowledge assets. However, they only expand efforts to the extent they perceive that the extra investments will buy increased viability and profitability and not interfere with other important functions. Figure 1 indicates several KM-related practices and activities pursued by advanced enterprises in 1996. The scope of KM is likely to expand further as the expertise to manage knowledge broadens and the competitive pressures to build and apply knowledge increase.

Proactive organizations obtain good results by including systematic knowledge management as part of their corporate practices. Whenever possible, they shape their approach to KM to reduce the overall workload instead of making work more complicated by introducing yet another set of tasks. As a result, the burden of work for managers or knowledge workers is reduced. That is achieved in many ways. Advanced practitioners observe that systematic KM often makes existing activities much more effective by streamlining them. This is particularly the case when activities have been disorganized in ways that resulted in conflicts that required considerable effort to correct or in excessive elapsed time.

7.4. The Future of KM from the Development, Supply, and Adoption Rate Perspective

From an evolutionary perspective the dynamic processes associated with the supply and demand of KM practices, methods, and technologies are of particular interest. The activities and involvements of developers, intermediaries, and end-users are particularly important. Considering present understandings of KM history and current evolution, we can postulate a possible scenario as exhibited in Fig. 2. This scenario is expressed in terms of development and application stages for developers, suppliers, and average end-use companies. Initially, developers consist of advanced user organizations, research organizations, and universities.

According to this scenario, we can expect that developers will have good operational models, methods, and many technological support aids by 1998 for their KM practices. Later, the developer community will have transferred sophisticated KM practices and solutions to general use 'everywhere' within their own organizations and to a few collaborating organizations. These practices will not, as often is the case within emerging areas, be immediately adopted by suppliers or the business community-at-large in spite of considerable competitive benefits realized by the users.

As indicated in the 20 year time-line presented above, suppliers such as consulting firms and technology vendors already have started to provide KM services and KM-related tools and building blocks, often as exploratory and beginning standardized solutions. Present services vary considerably in scope and sophistication and are provided to many progressive user organizations. Over the next years, we can expect that greater standardization will lead to greater productization. In the IT arena, knowledge mining tools, knowledge organizing support tools, knowledge-bases, groupware products, and KBS offerings are expected to increase in capabilities and penetration. However, it may take several years—or decades—before truly standardized

[9] 'Moore's law' sets expectations for doubling computer speed every 18 months (named after Gordon Moore, cofounder of Intel Corp.). Semiconductor industry executives expect Moore's law to be followed at least until 2010.

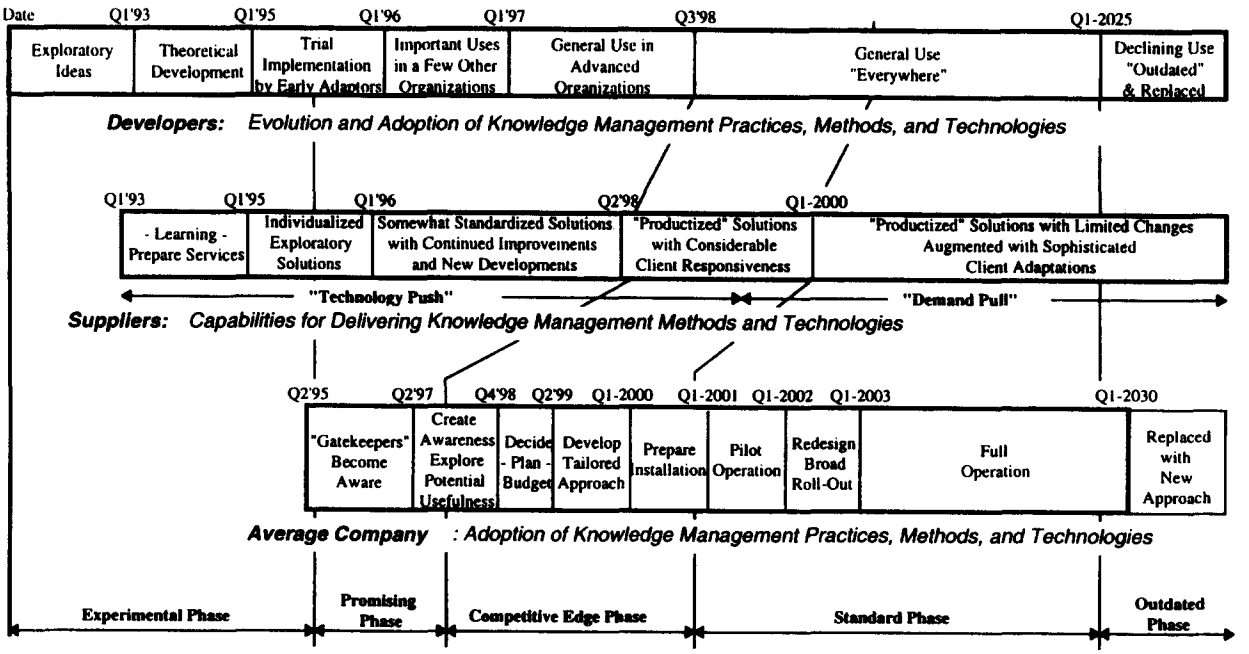

FIGURE 2. Possible scenario for adopting KM methods, practices, and technologies.

approaches will be available to allow 'mixing and matching' to serve special customer requirements and circumstances with systematically integrated approaches.

In the average enterprise, gatekeepers—curious senior managers, management scientists, and other promoters of advanced approaches—may generally be aware of KM methods and opportunities. Moreover, as indicated above, their top managers may not yet pay attention. Within the next ten years, most can be expected to explore KM and implement KM approaches. We should not expect these organizations to have KM practices in full operation until at least a decade from now. However, we do expect that they in the end will adopt various degrees of KM practices to remain competitive. As has happened with other new management directions of critical importance, enterprises that do not adopt KM can expect to be absorbed by more successful companies or disappear completely.

As indicated in Fig. 2, we can expect that KM methods and technologies generally will be provided in a 'technology push' manner for some time to come, perhaps until after the turn of the century. After that time, we can expect user organizations to seek KM products and services in a 'demand pull' fashion. This will lead to a well-established development and supply chain with accepted and tested methods and tools.

7.5. Possible Monitoring of Knowledge Management Effectiveness

To support enterprise-level monitoring and strategy setting we see it likely that something akin to systematic Intellectual Asset Accounting (IAA) will be developed and become common practice within time[10]. Such accounting will provide formalized approaches to describe the state of the enterprise's knowledge assets—the 'knowledge landscape'—and their potentials. The knowledge assets' current and future contributions to enterprise viability are of particular importance. The IAA may be included as the cornerstone of an Enterprise Viability Index (EVI) to summarize the present and expected future states of all critical assets (financial, knowledge, human resources, capital equipment, market position, etc.). The EVI would also include projections based on net renewal rates (new additions less losses or debits) of the various assets. Hence, the EVI might track present and estimated future enterprise performance by projecting value-added contributions from the present state and expected or planned changes. Clearly, such approaches are highly dependent on the availability of well developed and reliable dynamic value-process models of the type that several advanced organizations now frequently use to evaluate strategies and set priorities. Some already are basing their KM strategies on the explicit use of such models.

In the future, management teams, and employees at all levels, can be expected to be cognizant of, and analyze the impacts of, their actions in terms of the expected value-added contributions and resulting 'bottom-line'

[10] It is quite possible that the EVI may in part be based upon a categorization of assets similar to that now used by Skandia (1996) which breaks down an enterprise's market value into 'adjusted shareholders' equity' and 'intellectual capital'. Intellectual capital is again divided between 'human capital' and 'structural capital'.

end-value of their own work. We already see it in the use of systems thinking that has led to the use of impact propagation models to elucidate the dynamic transition of effects from present actions to bottom-line values. One such model is shown in the aggregate in Fig. 3. These models are closely related to, and often rely upon, dynamic value-process models for calculating quantitative estimates of the impacts. Given developments such as these, it is clear that advanced KM strategies are closely related to, and depend upon, increased sophistication of explicit understanding of the inner workings of the enterprise and how people work with their minds.

8. A BROADER PERSPECTIVE

The focus on what is involved in managing knowledge varies considerably depending upon which societal or enterprise level is involved. On national and local societal levels, the concerns are broad and we start to see systematic focus on how knowledge should be managed to benefit the viability of the societal unit. Some relevant foci and goals are indicated in Fig. 4. Examples are the emphasis on knowledge in Singapore, The Netherlands, the Scandinavian countries, the inclusion of KM perspectives in ESPRIT projects, and the recent establishment of a knowledge focus by OECD. These developments are of crucial importance to the future strength and international competitive position of the societies involved. The expressed concerns cover a wide range. One issue is the quality and scopes of industrial and university-level educational programs. Another deals with those concepts and meta-knowledge which need to be developed in children in their first school years to secure competitive positions for themselves and their country when they grow up. Some issues are well known and have been of concern for several decades, whereas others are new[11].

Of particular interest is the emerging understanding among educators and policymakers of the crucial importance for future competitive performance of preparing children and students. To improve understanding and learning ability, both children and adults must be provided with meta-cognition rather than just giving them shallow skills through rote training. They need—it is argued by advanced educators—in-depth concepts and mental models to gain fundamental understanding of generic principles of the physical and social worlds. They also need such extensive working knowledge of problem-solving, planning, and learning strategies. If we do not actively provide them with well-founded mental models, people, young and old, tend to develop their own. The self-developed models will most often be inaccurate or wrong since they invariably are based on limited information and prior insights. Early models tend to remain subconscious for life even after attempts to replace them with more correct ones later. Unfortunately, we have a long way to go before the insights into these issues are widespread enough to motivate decision makers to make changes in public policy and in public institutions.

Within the enterprise, the concerns are similar to the societal ones, albeit on a narrower scale. Depending on the particular KM focus, scopes and goals vary considerably as is also indicated in Fig. 4. We distinguish between five different levels—enterprise-wide focus, value chain focus, process and practices focus, work function focus, and detailed knowledge focus. On each lower level, the focus is tied to particular goals that in the aggregate supports the overall objective for the enter-

[11] See, for example, Kenneth Boulding's lecture "The image: Knowledge in life and society" (Boulding, 1956).

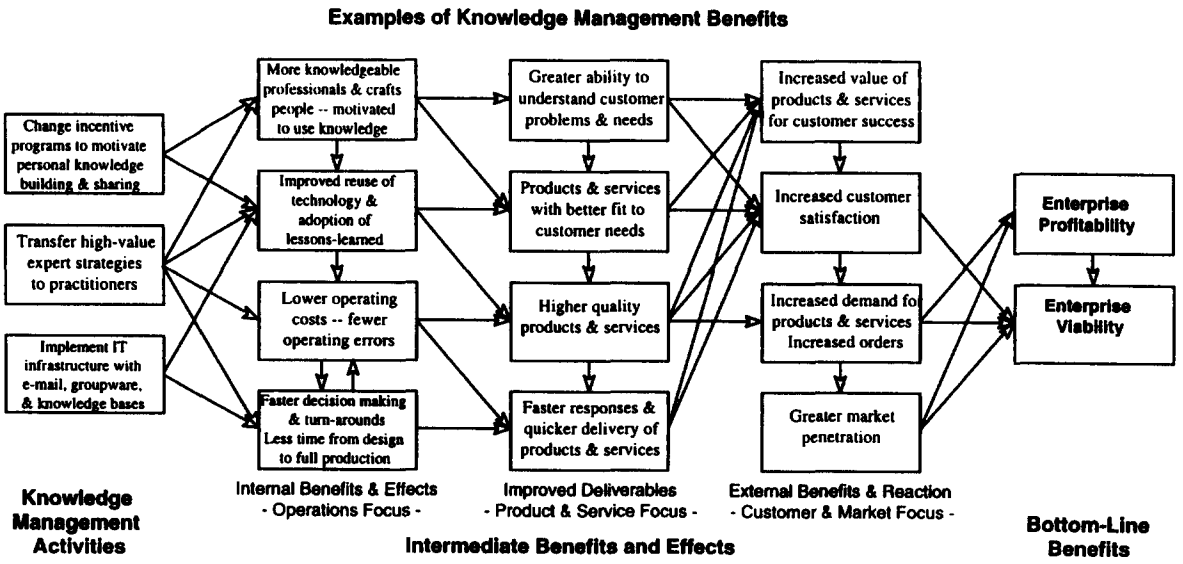

FIGURE 3. Model for translating value-added results from initial actions to bottom-line benefits.

prise, for example, its sustained profitability and viability. Hence, on the lowest level—the detailed knowledge focus—the goal will be to maximize task performance. On the next level, the goal will be to achieve intelligent behavior through effective use of knowledge. On the next higher level, the goal is to create and operate effective KM processes and practices to ascertain that both lower and higher goals are realized. Given these different foci, it becomes clear that the scope of comprehensive enterprise-wide management of knowledge can become large. In particular, all the activities, practices, and emphasis areas indicated in Figs 1 and 2 will be required to obtain the effects and achieve the performance that is expected.

9. CONCLUDING VIEWS

It appears clear that dependence on the human intellectual functions in working life will change over the next decades. Much of this change is driven by world-wide competitive forces stemming from increased reliance on personal and embedded knowledge. Success becomes a function of the quality of knowledge content available to create and deliver acceptable products and services, often tailored to individual customer's specific needs. Other changes will result from new workplace environments and organizational arrangements to promote collaboration, creativity, and performance improvements (Kao, 1996). Still other changes will be caused by increased supports from advanced IT—often in ways that we have not yet discovered. If we are fortunate, all these changes will lead to work lives that are more fulfilling and provide greater personal leverage.

We cannot expect that the knowledge society will be the last societal or management evolution. We do not yet know what the next turn of events will result in, but we can expect that the KM focus—even after it has been assimilated into the normal daily work tasks—will be pushed into the background by new priorities and approaches. It is reasonable to expect that such changes will take place in 25 to 30 years. When that happens, the need to manage knowledge cannot be expected to disappear. Instead, we will most likely find that management of knowledge processes and knowledge assets, along with management of intellectual, financial, physical, and other assets will have become routine with

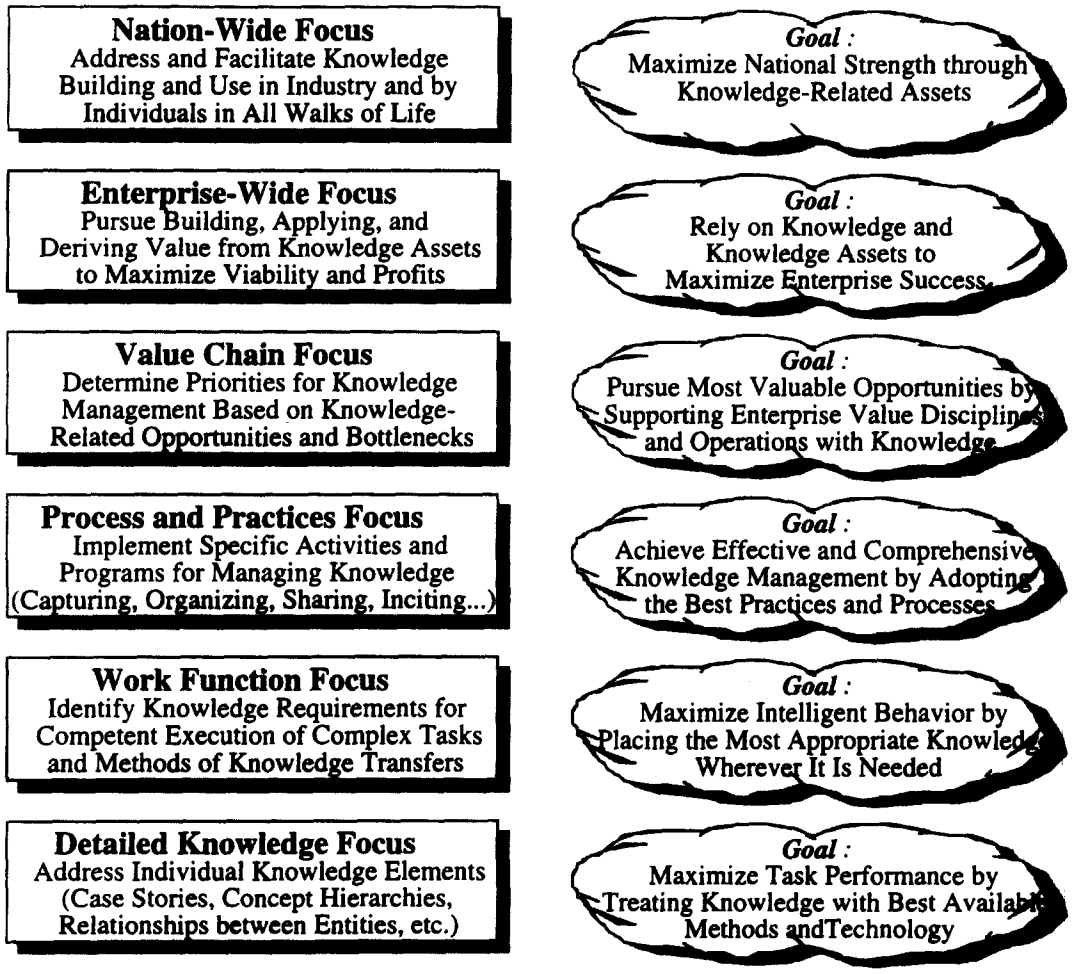

FIGURE 4. KM focus and goals at different societal and enterprise levels.

well-developed tools, practices, and monitoring approaches. Management of these assets will have become one of the important but low profile routine activities that are vital for enterprise success.

In the meantime, by actively pursuing comprehensive KM to excel in the three value disciplines—operational excellence, product leadership, and customer intimacy—enterprises will obtain the competitive advantages that will ensure their viability and profitability. We must expect that, as for other new management directions, advanced enterprises will be quick to adopt KM. Others will gradually follow suit, and still others will lag behind and not adopt KM approaches until competitive pressures force them to do so. Given the importance of effective knowledge management in the new competitive environment, organizations that remain with their old ways may find that they will be absorbed by more viable enterprises or go out of business.

More importantly, with knowledge being a major driving force behind the economics of ideas and hence behind new, resource-independent areas of growth, we can expect to find that emphasis on knowledge creation, development, organization, and leveraging will continue to be of prime focus for generations to come.

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