# Enterprise Knowledge Management

Knowledge Research Institute, Inc. White Paper by Karl M. Wiig
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Abstract
Systematic and deliberate management (KM) of knowledge-related processes and intellectual capital (IC) assets is pursued by competent enterprises throughout the world. Its purpose is to facilitate enterprise actions to be highly effective by building, maintaining, making available and safeguarding IC assets from operational, tactical and strategic perspectives. New understanding of KM’s role in the global knowledge economy, workers’ cognitive processes and advances in computer sciences makes KM increasingly important as it spans combinations of people-centric and technological approaches. However, KM’s focus must also be expanded to include pursuits of longer-term strategic and tactical requirements beyond its traditional operational role.

Introduction
The concept of “Knowledge Management” was coined in 1983 and is known to most business practitioners. Therefore, conventional aspects of KM may be of less interest for the proactive enterprise than new perspectives on the contexts of KM and some recent advances and practices. This white paper attempts to emphasize new perspectives, although for completeness, some established KM approaches are also discussed.

Making people more knowledgeable and operations smarter have been pursued informally and implicitly as long as people have conducted business. In 2007, structured and deliberate KM has become commonplace and is pursued to varying degrees in most enterprises, large and small and worldwide. In any enterprise, KM’s objective is to provide effective approaches to improve knowledge-related performance in the short and long terms. KM as practiced by competent enterprises and viewed in this white paper is:

“Knowledge Management (KM) is the systematic, explicit and deliberate management and operation of intellectual capital (IC) assets and knowledge-related processes – be they people-focused, technology-focused or with management or resource focus. KM includes the longer-term strategic and tactical initiatives to create, build, renew, utilize and safeguard IC assets and knowledge and its overall objective is to maximize the enterprise’s intellectual capital-related effectiveness and returns in all its forms.”

As indicated later, the purpose of managing knowledge – that is, the active and systematic initiatives to facilitate and guide IC and knowledge-related processes, activities and human behaviors – is to attain the enterprise’s goals in the shorter and longer terms.

Knowledge Management Initiatives Introduce Changes
Typically, valuable knowledge-related interventions must be created based on conceptualization of how business and detailed work should be done differently and better. Consequently, KM interventions – initiatives – introduce changes that require efforts to implement and may even be met with resistance unless approached appropriately.

A major change in many organizations is the deliberate reliance on systematic KM to strengthen the organization’s strategic directions in addition to making its tactics and daily operations more effective. Another change is the adoption of multi-disciplinary capabilities to make KM more effective in support of the enterprise. That has led to pursuit of advanced
technologies and integration with management, cognitive, social behavior and library sciences, to name a few. A third area of change is the extended penetration of the Internet and related technological and social developments such as the semantic web, wikis and powerful human interfaces designed to support knowledge worker cognition for support of both regular and difficult work.

Whereas much of the effort is focused on perfecting and broadening existing knowledge gathering, organizing and utilizing using technology, knowledge managers are realizing that most important business knowledge is tacit and cannot be captured at will. Furthermore, existing knowledge may be less helpful to address important complex work and novel challenges that require new approaches. These situations often need collaboration and creativity to develop new insights, judgments and both targeted and general knowledge that will be used to handle the particulars of the situation.

Enterprises of all kinds are challenged to be successful and viable by servicing their stakeholders competitively and effectively. Nowhere are these challenges more important than helping people to understand their work, make good decisions and execute them to implement actions that will contribute to enterprise performance. Challenges come from economic, political and social changes that affect how enterprises need to conduct strategies, tactical steps and daily operations. Challenges also come from advances in business practices, better knowledge and increased intellectual capital (IC) assets and in business-related technology. These issues force business leaders and in our context, Chief Information Officers (CIOs) to device the best approaches to create and maintain capabilities that make the enterprise successful and viable.

**The Importance of Knowledge**

A basic premise for KM is that improved access and application of better knowledge will result in better and quicker situation-handling (including decisions), increased innovation and greater ability to achieve goals. Knowledge, it is argued, is the dominant factor that fuels people's intellects, makes effective performance possible and leads to creation of new knowledge. Knowledge is the driver of economic growth -- in people, in organizations and in society. Without knowledge, intelligent and effective behavior -- the ability to interpret, assess, understand, innovate, decide, act and monitor -- will not be possible even if the best information is made available.

Based on these considerations, deliberate and systematic KM is required to provide the intellectual growth and renewal required for enterprise viability and success. KM makes the enterprise more effective in internal operations, customer understanding and service, marketplace success, financial performance and general stakeholder relations -- all measures of enterprise performance.

Organizations pursue KM with different foci and with many perceptions of what KM entails. Some consider KM to be a people-centered organizational learning (OL) focus. Others pursue KM with technological solutions to make structured knowledge readily available at points-of-use or to provide infrastructure capabilities that facilitate knowledge exchange and communication between people. Still others rely on KM to maximize the financial value of Intellectual Property (IP) assets such as patents and proprietary practices.
However, as stated by Quinn et al,1 "Surprisingly little attention has been given to managing professional intellect" and the focus is still often on observable aspects of IC – such as documented personal knowledge, kinds of structural knowledge and related information incorporated in technology-based systems while paying less attention to personal tacit knowledge and knowledge embedded in organizational systems and procedures or implicit in practices and traditions.

The Competent Enterprise

Enterprises need to be competent to perform well and prosper. However, it is often less clear what enterprise competence means. The notion of “being competent” in a particular domain focuses on the ability to handle tasks within the domain proficiently and effectively to achieve satisfactory outcomes. Competence requires several abilities – the ability to recognize and understand task situations within the objectives and scope of their contexts, to identify options and decide how to handle the situations and to act appropriately to implement the chosen actions effectively while also monitoring the appropriateness of each facet.

In our context of KM, we focus on ways in which knowledge contributes to competence and how KM-related initiatives must be considered to maintain and build it. For an enterprise to be competent it must have the intellectual, financial and physical resources to perform operational, tactical and strategic work well. Regular operational work results in provision of enterprise deliverables such as revenue producing products and services. The enterprise must consistently innovate and create new products and services to be competitive by satisfying customers and stakeholders. In addition, the enterprise as a whole needs to initiate and handle changes well, to adapt to new conditions by reestablishing operational and managerial practices and systems and procedures, change organizational structures and infrastructure to operate effectively in new contexts.

Every enterprise requires competences ranging from managerial and leadership competence to operational competence by people who deliver daily operational work. Basic building blocks of enterprise competence consist of the competence of its overall workforce – of every individual at all levels of the organization. It includes the implicit competence that is provided by its culture, its systems and procedures, its organizational structure, its management and operational practices, its infrastructure, its relationship with stakeholders and other capabilities. These competences result from the IC assets – knowledge – that have been built into all these capabilities, by upgrading the workforce through education and training, by deliberate design of systems and procedures and by implicitly and nonconsciously selecting approaches that work better.

Many competent enterprises try to avoid conditions where workers may be unprepared due to lack of knowledge. In such knowledge-deficient situations, knowledge-intensive work suffers from simplified understanding and inferior situation-handling of complicated situations resulting in less than desirable performance. Executives in competent enterprises attempt for lower ranks to be prepared to make learned and authoritative decisions by possessing sufficient knowledge or having access to other sources of expertise. Their rationale is that competent decisions made locally will be made faster, with better understanding of the situation that will result in quicker actions with higher work product quality and cost savings. When workers possess good

1 Quinn et al 1996.
knowledge and understand enterprise strategy and intents, managers may delegate authority to coordinate, to decide, to shape situation solutions and to implement decisions. Managers use KM in coordination with information and communication technology (ICT), human resources (HR) and the operating department to ascertain that appropriate knowledge will be at the point-of-action to handle the expected work well. When more difficult work challenges are beyond the assigned scope, situation-handling is shifted to individuals with greater expertise and responsibility.

**Skills and Knowledge Are Not Sufficient!**

Consider the “Competent Performer” (see later) who possesses good skills and knowledge. However, good skills and knowledge are not sufficient. In order to deliver quality work, the Competent Performer must also have positive attitude, conviction that she or he is doing the right thing and understand how to support enterprise intents and strategy. In addition and very importantly, the Competent Performer must have appropriate access to pertinent information that describes the actual task situation and context. That makes information management a crucial co-contributor to enterprise performance in ways that often are not pursued to the fullest.

Owners, managers and individuals in the workforce all work to make their enterprises succeed. Commercial enterprises have goals to be profitable and viable by operating effectively, satisfying customer expectations and attaining competitive market positioning. Non-commercial enterprises also seek to fulfill strategic goals and satisfy stakeholders. For enterprises to perform as expected, executives and personnel at all levels must create and pursue effective strategies that they implement with good tactical and operational actions. They must understand the environments and contexts in which they operate. They must operate efficiently and effectively to daily produce and deliver products and services. They must foresee oncoming problem situations and challenges and build capabilities to guard against and handle them. They must innovate to improve their products, services and operations. They must be agile to handle changes flexibly. In short, they must be able to operate effectively in chaordic environments.²

**The Informed Enterprise**

In the “informed enterprise,” effective KM provides the initiatives required to create a shared understanding throughout the enterprise about its intents and strategy. It has been demonstrated by many that this understanding is a prerequisite for enterprise excellence and success. Enterprises as widely distributed as General Electric, Nokia, Analog Devices and SAS Institute have achieved such shared understanding broadly throughout the organization. Unfortunately, for organizations to be effective informed enterprises, they also need to be ethical and transparent.³ Ethics and transparency foster trust and cooperation among others and thereby reduces dysfunctional tendencies like silos and not-invented-here tendencies. In the informed enterprise, knowledge workers understand the degree to which their personal fortunes are tied to enterprise performance. They also understand and agree what they need to do and how they need to behave to achieve the desired performance.

Hence, in 2007, we must consider the field of KM to provide highly important capabilities needed for the enterprise’s welfare and success. The major problems with KM, however, is that its

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² Hock 1997.

successful practice is difficult and bridges disciplines and enterprise silos that traditionally have not been integrated and where communications between entities are limited. As a result, the history of KM provides unfortunate statistics of KM initiatives that have not lived up to expectations, fallen quickly into disuse, or have failed outright.

**Knowledge, Information, Intellectual Capital and Intellectual Property**

To be effective in all types of work, we will distinguish between existing knowledge and new knowledge. For example, existing knowledge is appropriate for handling known work and to be applied to handle known aspects of new challenges. New knowledge is developed through R&D, creative collaborations and in many other ways as needed to handle previously unknown aspects of challenges and problematic situations.

Knowledge that is needed by employees can be separated into five topic areas, each which can be possessed – or obtained from experts, colleagues or ICT support systems – at different levels of conceptual comprehension. People can possess knowledge in the form of mental models at different levels of depth: as rudimentary understanding, “how-to” operational understanding, deeper “script” understanding and good general and schematic understanding of the area. As people delve into a knowledge area, they will develop metaknowledge of that area. The five topic areas considered here are:

1. **Task Specific Knowledge**: Knowledge of how to perform work tasks and how these relate to the operational area and the enterprise – be it profit-making corporations, societal bureaucracies or private family units. This topic area also includes understanding of appropriate behavior.

2. **Enterprise Knowledge**: Understanding of the enterprise’s practices and policies, structure, operation, strategy, intents and direction. It includes knowledge of products, services, customers, and suppliers. The area also includes understanding of the enterprise’s resources, its strengths and weaknesses.

3. **Relationship Knowledge**: Understanding of stakeholders ranging from suppliers, customers, coworkers, family and friends, and how to behave. This topic area also includes navigational knowledge and understanding relationships within the enterprise and to external entities, relationships to exchange information, and to obtain assistance.

4. **Context Knowledge**: Understanding of the context in which the industry operates, its role in society, the competitive environment and its future prospects.

5. **Broad World Knowledge**: Knowledge the state and trends of economics, geography, social and political aspects, science and technology.

6. **Methodological Knowledge**: Knowledge such as of critical thinking, mathematics, statistics, investigative methods, planning systems, personnel handling approaches, and so on.

Existing knowledge reflects experiences, understanding, judgments and developments (how past work has led to new reflections beyond what then was known) of past work challenges and expectations for new opportunities and contexts. Existing knowledge in its most tangible forms is explicit – often in documents or organized into knowledge bases (KBs), embedded in automated

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4 Discussion of different kinds of knowledge is presented in Wiig 2004.
5 On mental models see Johnson-Laird 2006.
6 See Kuhn 2000 and Wiig 2004 op. cit. pages 86 & 326.
systems and in manual systems and procedures, or implicit in products and services, in work practices and in understandings of what works and what does not. The greater part of existing knowledge is tacit and possessed by people in their minds in ways that they cannot make explicit. However, they can access tacit knowledge mentally (often through priming memory) and partly shared with others while conducting real work and solving problems. The mechanisms by which tacit knowledge is built in the mind and made available are better understood from recent cognitive science research in ways that assist practical people-focused KM (PFKM).

**Knowledge and Information Are Different**

The different operational purposes of knowledge and information in the enterprise are different and quite clear. However, explicit knowledge is typically communicated as information in one form or another. When considering how knowledge affects personal decision making and reasoning, we need to understand what knowledge is and how it relates to information.

As indicated, knowledge consists of facts, perspectives and concepts, mental reference models, truths and beliefs, judgments and expectations, methodologies and know-how. Facts, which also can be considered to be information, when becoming knowledge is integrated and understood in relation to other knowledge. As an example for how facts can be considered to be knowledge by being integrated and understood, consider how the facts, including data, about an enterprise’s logistical details – routes, distances, time tables, transport equipment, normal congestion situations, etc. – lead logistics personnel to build knowledge of what the best routings and carriers might be for specific types of shipments. These facts and data are further internalized to help determine new shipment options as well.

The **purpose of knowledge** is to understand observations and situations, to determine options for action and to implement effective action by providing people with capabilities with which to reason. In part, knowledge also consists of understanding of how to juxtapose and integrate seemingly isolated information items to develop new meanings as in the example above – to create new insights with which to approach effective handling of target situations. Knowledge is used to explore, evaluate and handle situations, assess, decide, problem-solve, plan, act and monitor. As such, knowledge is mostly tacit, implicit and difficult to examine. For the most part, knowledge cannot be managed directly, only indirectly by managing knowledge-related processes.

Information consists of data organized to characterize a particular situation, condition, context, challenge or opportunity. The **purpose of information** is to describe and specify conditions, things, and concepts – any kind of describable concrete or abstract object. Information is mostly explicit, readily examined and its management requires conscientious and detailed attention to logical manipulation, storage, presentation and distribution.

Since both the purpose and nature of information is different from that of knowledge the implications are that KM must be fundamentally different than information management (IM). Knowledge and information are not part of a continuum and need to be managed separately and diligently by separate disciplines.

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7 Wiig 2004 op. cit.
8 Fauconnier & Turner 2003.


**Information Is Subordinate to Knowledge**

The different roles of knowledge and information in support of work of any kind are indicated in Figure 1, which also illustrates why KM and IM are both separate and necessary. However, one very important issue that has been overlooked in many organizations is the need for information and knowledge to match – and in particular, for information to match the workplace situations-handling that is governed by application of available knowledge and hence makes it subordinate to knowledge. For the best knowledge to be fully applicable, it must have access to information that matches its needs in timeliness, granularity and all other dimensions of concern. Ideally, information must also be accessible in ways that do not impede situation-handling.

![Diagram: Knowledge Management of Knowledge Capital and Information Management of Information Capital](image)

**Figure 1.** Knowledge and Information Have Different Roles in Work. Hence, Knowledge Management and Information Management Are Both Important and Contribute Jointly to Provide Intellectual Capital to Handle Business Tasks.

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**Intellectual Capital**

When considering the broader responsibilities of KM in the enterprise, we need to include the perspectives of IC. As shown in Figure 2, IC is one of the two building blocks of “Corporate Capital.” The second building block is “Physical Capital.” The concept of IC was established in the early 1990s and is still subject of extensive analysis and debate. However, the version in Figure 3 is generally accepted.

In general IC accounts for current assets, that which is in existence now. This, in part differs from the scope of KM, which must also pursue initiatives, and developments of tactical and strategic future capabilities. The elements of IC that have direct interest for KM – apart from the many forms of “Structural Capital” – include the “HR & Workforce” parts of “Stakeholder Resources” which includes explicit, embedded and implicit knowledge. The workforce assets represent knowledge possessed by people at all levels of the enterprise. However, all the

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enterprise’s stakeholder resources must be considered to be on loan to the enterprise from its employees. Employees generally do not in any sense “belong” to or can be controlled by the enterprise except when they possess highly proprietary knowledge that contractually cannot be used elsewhere. The enterprise can only take advantage and foster development of personally possessed IC assets by facilitating cooperation and providing incentives.

![Diagram: Intellectual Capital and Its Building Blocks as Part of Corporate Capital](image)

**Figure 2. Intellectual Capital and Its Building Blocks as Part of Corporate Capital.**  
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The more tangible IC elements of the “Structural Capital” are often considered to be most important for KM in that they generally are easier to deal with by being observable and measurable. The fact that they are of less importance to enterprise performance than people’s knowledge is typically not considered.

**Knowledge Work**

Knowledge work in the enterprise can be separated into regular operational work, tactical work and strategic work. The daily activities of selling, producing and delivering goods and services are part of operational work. So are back-office operations and staff work such as many HR activities, regular physical plant maintenance and support of stakeholder relations. Most operational work comprises the activities that directly generate revenues or fulfill the operational mission of the enterprise. They therefore are of central value, particularly in the short term by implementing the enterprise’s mission and strategic intents on a daily basis.

For KM to support work well, understanding is required of the nature of knowledge needed for different kinds of tasks. Hence, there are needs to categorize work, knowledge and proficiencies.
Categorizations are needed of work complexity, of workers by skill and knowledge levels, of work domains by the functions performed for the enterprise and of the many manifestations of knowledge.

**Operational, Tactical and Strategic Work**

**Operational Work**

The daily activities of selling, producing and delivering goods and services are part of operational work which often is basic or routine work performed by workers without extensive training or education. More demanding work is performed by apprentices and competent and proficient performers who have extensive training and expertise. For operational work to be executed efficiently, reliably and accurately, workers must possess considerable, albeit targeted, skills and knowledge that regularly must be renewed and expanded to handle changes and new requirements. Intelligent automated work systems must also have its embedded knowledge updated to be appropriate and up-to-date. Established systems and procedures must be built to reflect best available knowledge, which by their nature, will be embedded implicitly and must be updated as well.

Operational work requires task-specific skills and knowledge and that often is well suited to be supported by KM. Some operational work also needs good world and methodological knowledge (see later), particularly to deal with difficult irregularities and problem situations that should be dealt with on-site and just-in-time. One example is the broad knowledge required by logistics dispatchers when they must handle logistics systems problems that originate externally to their organization.

**Tactical Work**

Tactical work can be relatively well defined and may be projected and forecasted. Its function is partly to support the enterprise strategy by interpreting its operational requirements and securing and operationalizing resources and capabilities needed for implementation. Tactical work also supports operations by ascertaining that operational capabilities are renewed and maintained as required. It also must facilitate that tactical and operational innovation are brought to bear to improve products and services and making operations as effective as at all possible. Tactical work by its nature is more complicated and complex than operational work. On an individual workday’s basis, tactical work is more valuable than operational work by securing that the enterprise’s effectiveness in the marketplace and among its customers is maintained.

Tactical work requires relatively broad world and industry knowledge and excellent enterprise and methodological knowledge. These knowledge areas are good candidates for PFKM and KM system support, particularly for less dynamic knowledge. The more dynamic areas where knowledge changes quickly or need to be developed to address novel situations are candidates for PFKM such as creative communities of practice (CoPs), collaboration and other people-focused approaches.

**Strategic Work**

Strategic work deals with determining the enterprise’s direction. Most strategic work cannot be well defined and much of it deals with re-determining the enterprise’s direction and intents as
external and internal conditions and contexts change. Strategic work is always complicated and can be complex and often involves developing new understanding of what the new changes and scenarios are, what their consequences might be and what best should be done. Strategic tasks must also address numerous internal issues to shape the enterprise’s capabilities such as deciding on changes to personnel and training, which new product and service lines should be developed and which organizational structure will best serve the new strategies.

Strategic work requires broad knowledge covering general world knowledge, specific industry knowledge and knowledge of the enterprise’s strengths, weaknesses and general characteristics. Strategic work also requires methodological knowledge – possibly this knowledge is the best defined knowledge that usefully can be supported by structural KM.

**Complexity of Work**

Enterprise situations vary widely. Some work situations, such as fast, reliable and error free assembly, are well-known and require routine, even automatized and internalized knowledge in people’s minds. Other situations, such as project work to find solutions to stubborn operating problems, are complicated and require extensive, at times abstract, knowledge and metaknowledge. Even in well-known routine cases, effective situation-handling involves many steps and requires specialized knowledge. However, most work is “simple” to a considerable extent. In many organizations much of simple work is automated using technologies like robotics in manufacturing or simple logic and operations or knowledge-based systems in clerical and professional work. Hence, we consider seven categories of knowledge work as follows:

1. **Basic Routine Work**: - Simple, repetitive and well understood work that in the aggregate is important to the enterprise. This work can be scheduled with confidence. Some can be performed by unskilled workers and novices.\(^{10}\)

2. **Near Routine Work**: - Logical and common variations of daily routine work that can be planned with good certainty. In the aggregate this often is the bulk of important daily work. Some can be performed by apprentices while competent and proficient performers provide most of the work.

3. **Regular Complicated Work**: - Complicated extensions of routine work are required for high quality results and regularly require competent performers for good execution. In the aggregate, this work is important and can be forecasted and planned with some certainty. Operational planning often falls into this category.

4. **Uncommon Complicated Work**: - Uncommon and unexpected less known variations of routine work that can only be planned with uncertainty and forecasted as contingencies. This work is important for daily and future operations. It is often needed to avert problems and typically requires proficient performers for successful completion. Planning for organizational and operational changes falls into this category.

5. **Complex Work**: - Whereas this work may be partially understood by specialists, it often includes resolution of conflicts and for effective results, typically requires systems perspectives and integration of areas that cannot be known in detail. Complex work requires experts and elite performers and is very important for enterprise viability. Part of it can be planned whereas other

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\(^{10}\) For definitions of worker categories, see below.
situations can only be expected with uncertainty. Determination of strategic directions, enterprise organization, strategic partners fall into this category.

6. Chaotic Work Challenges: - This work represents difficult, not understood and ill-defined situations that cannot be expected with any certainty. They are unusual “Wicked” problem situations outside expected work scopes that require expert and elite performers and are of great enterprise importance. Unexpected market and technological challenges fall into this category.

7. “Black Swan” Events: These challenges cannot be foreseen and are totally unexpected, without precedence and can have monumental or catastrophic impact – and can in some instances provide unexpected opportunities. They must be dealt with by the best expert and elite performers available. Unexpected terrorist attacks, social unrests and economic crashes fall into this category.

Functional Activity Areas in the Enterprise

To help determine which knowledge work can be performed by different worker categories (see later), five functional activity areas are identified for the enterprise as illustrated in Figure 3 and described as follows:

1. Perform Daily Work and Regular Operational Functions – to market, deliver and service the enterprise’s basic deliverables such as revenue producing products and services by utilizing the best available enterprise capabilities. Provide operational support such as information and communication technology (ICT) services and conduct back-room operations and regular HR functions such as hiring, firing, education and training. This work mostly involves Basic Routine, Near Routine and Regular Complicated Work.

2. Innovate to Improve Regular Operational Functions – to achieve greater efficiency (reduced operational efforts and costs), improve quality of work and organizational agility in order to improve customer satisfaction and provide greater enterprise performance. Plan and schedule changes and modifications of capabilities. This work mostly involves Near Routine, Regular Complicated and Uncommon Complicated Work.

3. Perform Tactical Functions – to secure and organize enterprise resources and capabilities needed to implement enterprise strategy and to proactively improve management and operational practices, systems and procedures, organizational structures and infrastructure. Prepare tactical directions needed to implement enterprise strategy. Examples include introduction of totally new products and services, entering new markets and creation of new ICT capabilities. This work mostly involves Regular Complicated, Uncommon Complicated and Complex Work.

4. Perform General Management Functions – to manage all levels and operations of the enterprise, prepare the enterprise to handle challenges, establish strategic relationships, build budgets, develop plans and explore options and opportunities to be pursued. This work mostly involves Uncommon Complicated, Complex and Chaotic Work.

5. Perform Strategic Functions – to devise the enterprise’s future by shaping its strategy, establish enterprise management principles and policy and handle difficult challenges effectively. This work mostly involves Complex and Chaotic Work and Black Swan Events.

For illustration purposes, worker competencies for areas 1, 2 and 3 in Figure 3 are shown to be limited. Clearly, that is not realistic since any functional area should have top performers within their ranks.

![Worker Competency Categories](image)

**Figure 3. The Enterprise Functional Activity Areas Illustrated as Regions of Worker Competencies and Work Complexity.**

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**The Value of Work**

For some enterprises the short- and long-term value of its daily operational work will be greater than the value of its tactical and strategic work. That is the case for mature organizations with stable operating and marketing environments where strategic changes are slow, orderly and predictable. Many public service organizations and mature or declining enterprises have these characteristics. Normally, work in these organizations ranges from basic routine work to uncommon complicated work with complex work being less frequent as long as enterprise environment and direction remain stable.

However, the majority of successful enterprises are both proactive and agile as needed in the dynamic environment in which they operate. They actively explore and innovate to improve
products and services, make operations more effective, improve relationships with customers, suppliers and other stakeholders and pursue adaptive strategies that will provide the best performance. Their behaviors and culture require savvy and knowledgeable “situation-handling” (see later) and extensive, pertinent and reliable information.

Proactive organizations require that people at every level make good decisions for uniform performance and rely upon distributed competence – knowledge – for decisions to be made and actions to be taken at the point of need. In these enterprises, operating, tactical and strategic functions are dynamic with frequent changes that often are significant in both extent and value. They work to pursue new opportunities, correct problems and in some cases, avert disasters.

The complexity of work cover the full range from basic routine work to chaotic work challenges – and at very rare times, Black Swan event challenges. Their environments are “chaotic” and require strong capabilities to deal effectively with chaotic effects of external and strategic changes while at the same providing the orderly and stable conditions needed to provide desirable operating conditions for daily work. In these enterprises, the long-term value of strategic work tends to have the greatest value by securing enterprise viability compared to tactical and operational work. For them to perform well, they need highly competent people at every level of the organization. For long-term viability, they also need deliberate initiatives to renew every competency. Much of this responsibility for renewal rests with KM.

**Situation-Handling**

Understanding how people and organizations handle situations, including the associated tasks of decision-making and problem-solving, is important for successful KM. This understanding requires insights into areas as diverse as situation-handling practices, cognitive sciences, knowledge transfer methods, microeconomics, management principles and supporting information technology. Such insights are required to diagnose knowledge-related operations, conceptualize KM initiatives, implement capabilities and assess and monitor utilization of knowledge-related resources and practices. Acquiring the requisite understanding of knowledge-related mechanisms on the personal and organizational levels takes KM professionals into new fields and requires of them to view work and operations from perspectives that may be new to most.

People handle work tasks and challenges – situations – by giving them attention, identifying what they are about, exploring and making decisions about what to do to handle them appropriately, by implementing the decisions – the selected actions – and monitoring what is happening, explicitly or tacitly. Situation-handling can be separated into four primary tasks: (1) Sensemaking; (2) Decision-Making/Problem-Solving; (3) Implementation; and (4) Monitoring.

A simplified schematic overview of the relationships between these four tasks is indicated in Figure 4. The functional capabilities needed to operationalize each primary task are: Situational Awareness; Action Space and Innovation Capability; Execution Capability; and Governance Competence and Perspectives. The proficiency of these capabilities is highly dependent upon the extent and quality of knowledge that people possess or otherwise made available to tackle the

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12 Hock 1997.
13 Situation-handling is discussed by Wiig 2004 op. cit.

tasks by support systems and automation. If Functional Capacity knowledge is limited or competence is otherwise reduced, the capabilities will become constraints that reduce the effectiveness and performance and thereby the overall performance of the enterprise. Figure 4 indicates some connecting variables and paths along which information and knowledge enter the process.

![Figure 4. The Personal Situation-Handling Model – from Situation and Sensemaking to Implemented Effective Action and Monitoring.](Image)

Knowledge Workers and the Importance of the Individual

The performance of the enterprise is based on its employee’s voluntary actions in support of the organization’s intents and goals. Each worker’s actions are based on deeply internalized tacit values, beliefs, judgments, understandings and specific knowledge. The overall enterprise performance and viability results from innumerable small actions by individuals and automated systems. As illustrated in Figure 5, the small individual actions combine with larger departmental and enterprise actions that combine to create the consolidated behavior and performance of the whole organization. The quality and extent of knowledge possessed by people – their competence – and the private and structural IC assets otherwise available to them determine the realized enterprise performance.

Only in the last decades have we started to understand the cognitive functions of knowledge workers when they engage in work. There is increasing understanding of the complexity, utility and business value of how proficient workers apply the knowledge they possess to analyze and interpret situations to decide and deliver quality work. This is the case in higher levels of work by managers and professionals. It is also the case for “simpler work” in factories and small businesses where the variety of challenges and the needs for knowledge and judgment are important for delivery of quality work products – be they correction of errors, or other problems. We are learning how to strengthen workers’ cognition while working by providing them with just-in-time collaboration, automated decision support systems (DSSs) and other sources knowledge in various forms. These capabilities also reduce the needs to educate or train workers to handle rarely encountered tasks.
Figure 5. Individual Personal Actions Accumulate to Departmental Actions That Consolidate to Enterprise Behavior Resulting in Enterprise Performance.

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The function of personally possessed knowledge to achieve effective organizational performance is also becoming clearer. Early on, managerial emphasis on work procedures and methods was placed on observable work. Later it included information and information flows, which are also observable. Focus has now shifted to include less observable cognition and knowledge. Whereas it has always been understood that know-how and expertise influence quality of work, the knowledge focus brought about by the global knowledge economy has brought new emphasis on the individual educational and training. There also is additional understanding of invisible work, particularly on how workers think and utilize knowledge when performing tasks ranging from simple to complex. There is understanding of how workplace effectiveness can be improved with better worker-understanding of upstream and downstream work and processes. With such understanding, workers are able to identify how upstream work may affect their own tasks and how their work products may affect downstream processes. Thus, workers are able to act proactively in problem situations and are often able to identify opportunities for process improvements.

Knowledge Workers

Whereas some consider personal knowledge to primarily be important for ‘white collar’ knowledge workers, in the knowledge economy, people at every working level must possess good personal knowledge and skills to deal competently with daily work. They must be flexible to deal with variations in tasks. They must handle computer systems and other advanced work-aids. They must be agile and adapt to different work and to take on different responsibilities.
By understanding the working individual’s knowledge functions and needs, makes it possible to create more effective KM initiatives. That is achieved by considering which knowledge different workers must possess in their minds and how much additional knowledge can be obtained from KM systems and from collaborators and experts to ascertain that their work will be effective. The scope of KM must support efforts to realize the desired performance, by building needed knowledge assets systematically and deliberately. As people gain understanding and experience, their competence increases and they progress from being unskilled at the beginning to higher levels of proficiency. Seven proficiency categories for workers are considered in terms of their knowledge and skill levels:

1. **Unskilled Workers**: Are unaware of specific job requirements, with limited understanding or judgment – can perform basic routine work with minimal training.

2. **Beginners – Novices**: Have beginning awareness of field – begin to build skills and real experience (Amateurish).

3. **Advanced Beginners – Apprentices**: Are aware and partially informed with beginning deeper understanding – are skilled in narrow areas.

4. **Competent Performers – Journeymen**: Are competent and broadly skilled – are knowledgeable in selected areas.

5. **Proficient Performers – Craftsmen**: Are highly proficient in particular areas – are generally knowledgeable.

6. **Expert Performers – Masters**: Are highly experts in many areas and broadly knowledgeable.

7. **Elite Performers – Grand Masters**: Are world class experts in all areas of the knowledge domain.

A different perspective of knowledge workers has been proposed by McKinsey by distinguishing between three kinds of work that generally is performed. The three kinds are:

1. **Tacit Interaction Workers** – “Complex interactions (decision making, collaboration, knowledge consumption)” involves nonroutine challenges, mostly with competing objectives that require collaborative and complex problem solving that relies on exchange of information, judgments and consideration of multifaceted forms of knowledge in exchanges with coworkers, customers and suppliers.

2. **Transaction Workers** – “Routine interactions (standardized, invariable tasks)” is relatively routine desk-work such as work by insurance clerks, payroll accountants.

3. **Transformational Workers** – “Extract and convert raw materials” involves fully routine work associated with physical work such as manufacturing, transportation and the like.

Whereas these categories are attractive, they are too simplistic since they do not recognize the variety of challenges that regularly are encountered and must be addressed in even the simplest types of work. These challenges must be handled competently to deliver quality work products consistently. A person who only can handle the basics of routine work – no matter how quickly

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and well – is a liability in any work environment if not supported by more competent individuals to handle irregularities and problems.

**Knowledge Management**

In order to ascertain that the enterprise competence is built and maintained to the best advantage in the short and long terms, KM must be undertaken. Knowledge management (KM) is not a single discipline – instead, it is an integrated field that draws on many disciplines that allows it to pursue initiatives in many domains and on several levels within the enterprise. KM works operationally to facilitate and promote use of existing knowledge assets with a “now-horizon” in support of ongoing daily work. Operationally, it also works with a forward-looking horizon to create new knowledge assets and knowledge-related capabilities. These range from harvesting, codifying and embedding knowledge into technical systems, to providing education and training, to conducting R&D and otherwise building IC and to building related infrastructure. The wider domain of KM additionally engages in tactical and strategic activities. Examples of these facets of KM are illustrated in Figure 6 below.

**The Purpose of Knowledge Management in the Enterprise**

The notion behind KM is that personal and organizational knowledge – be it tacit, explicit, embedded or implicit – provide the foundation for the enterprise’s competence. That makes it not only desirable, but mandatory, to manage short-term and long-term knowledge-related processes deliberately and systematically throughout the enterprise.

The purpose of KM is to build, maintain, make available and safeguard IC assets in the short and long term and thereby to ascertain that the state of IC assets of all kinds is a beneficial to the enterprise’s mission as at all possible. Deliberate and targeted KM makes it possible for people – and to some extent, automated systems – to make better, more knowledgeable decisions and to generally perform work better so as to secure desirable enterprise performance. Another role of KM, as indicated above, is to promote shared understanding of how to implement enterprise strategy through tactical and operational work and to share knowledge within teams about different aspects of operational work. In many enterprises, KM also serves to ascertain that IC assets are safeguarded and that their value is appropriately exploited.

In addition to internal and external challenges and structural changes, a major problem in most enterprises is the lack of people with higher levels of competence. The reasons being that people retire, change positions, are promoted or leave the organization. Consequently, there are constant needs to build knowledge a transfer expertise to ascertain that proper IC will be available at the point-of-action (PoA).

If all future work were only to consist of simple continuations of today’s work, existing knowledge would be all one needed for effective KM. However, as indicated above, today’s enterprises are chaotic and much work, often the most important work, must deal competently with internal and external changes, unanticipated opportunities and challenges. Hence, effective KM must also address ways to prepare the enterprise from a knowledge point-of-view to meet these demands, which generally are largely unknown.
**Determining KM Strategy and Initiatives**

For the enterprise to benefit fully from KM, broad options must be explored to determine where and how to direct the efforts. On paper, a host of KM alternatives are possible – even potentially beneficial. However, several factors make some of the choices more attractive than others. The enterprise’s special needs, its professional capabilities, its resources, its culture and practices all will determine the attractiveness and feasibility of alternatives. In addition, determining factors also include the employee’s understanding of the KM realm in general, what is possible within the enterprise and how it would work in practice and particularly, how changes introduced by the alternatives would impact the enterprise.

An important issue for KM deals with planning and setting priorities for KM initiatives, particularly according to where maximum returns for KM efforts can be obtained. That is only feasible when it is understood which work is to be undertaken, by whom, for which purpose and what the relative value is of the different kinds of work.

**Long-Term Plans Must Be Driven by Enterprise Strategy**

**Knowledge Management and Corporate Strategy**

The general opportunities and needs to coordinate enterprise strategy and KM are highlighted in the statement by Sporleder and Peterson\(^{15}\) from the agrifood industry and is likely to be valid everywhere:

> “This evolving shift in the basis of rivalry among firms puts increasing demands on corporate strategy. A future challenge for agrifood firms is to embrace strategy that includes, at least conceptually, knowledge as a strategic asset of a firm. Knowledge and its management are emerging in contemporary thought as a potential source of sustainable competitive advantage.”

It is clear that to support the enterprise in its goals to be progressive and viable, KM must consider the full range of operational, tactical, and strategic needs. That is a change from traditional KM and requires involvement of senior management in new ways.

**Operational KM Considerations**

Operational KM perspectives focus on creating and fostering general KM practices and initiating and managing individual knowledge processes. Examples include: implementing KM practices such as life-long learning programs and expert networks to assist decision makers in specific enterprise functions. Operational KM objectives emphasize collecting, organizing, transferring and utilizing knowledge. Operational KM also includes creating and operating KM systems, establishing external KM connections and partnering,

**Tactical KM Considerations**

Tactical KM perspectives focus on exploiting knowledge processes to achieve more effective operations. Examples from include: KM-supported innovation to reduce unnecessary bureaucratic procedures, time required to provide service and employee turnover. Tactical KM objectives are

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\(^{15}\) Sporleder & Peterson 2003.
to facilitate operational KM by creating KM infrastructure, build KM staff capabilities, establish KM practices,

**Strategic KM Considerations**

Strategic KM Perspectives focus on creating and expanding relationships with customers, suppliers, strategic partners and other stakeholders to meet enterprise goals. Examples include: the development of new approaches based on knowledge capabilities and the outsourcing of innovation to suppliers. Strategic KM objectives are: (1) To assist enterprise strategy creation by providing insights into how KM can support, improve or expand enterprise strategy; and (2) To determine direction for KM based on how KM needs to support and implement enterprise strategy, tactical efforts and daily regular operations.

**Examples of KM Agendas on the Strategic, Tactical and Operational Levels**

Traditionally, KM has focused on operational activities, i.e., how knowledge is collected, organized, shared and utilized. This focus has in many enterprises been on the use of technology while in others it has been on people-centric learning organization (LO) approaches. With the increasing importance of application of effective knowledge at all levels of the enterprise and from the pressures from global knowledge economy developments, a broader focus for KM is required – that of serving strategic and tactical facets of conducting business in addition to the customary operational aspects. The broader perspectives hence result in strategic and tactical KM requirements as indicated by the examples in Figure 6.

Comparatively, KM support of operational work is relatively straight forward since it often is possible to define and describe normal tasks and their situation-handling concisely and concretely. Also, knowledge for operational work tends to be less dynamic than for tactical and strategic work and therefore may lend itself better for explication and inclusion in KBs and DSSs. However, most operational work will also have surprises – problem situations involving things that go wrong or are difficult and infrequent tasks that require specialized knowledge may require on-site decision making and needs for fast actions to avert greater problems – or just to expedite work by lessening operational friction.

Tactical and particularly strategic, work is more challenging than operational work. However, the value of this work tends to be high by leading to significant enterprise changes and related activities. The nature of KM for tactical and strategic work fall into different areas such as creating ICT supported knowledge-based modeling for complicated “what-if” analysis, knowledge mining in unstructured natural language KBs, social software for collaboration and CoP support and general infrastructure capabilities. However, the major challenges result from the broad range of tasks that these functions must address – many of which deal with novel situations which need creative solutions based on new knowledge.
Figure 6. Examples of Strategic, Tactical and Operational Knowledge Management-Related Considerations, Plans, Initiatives and Activities.

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Knowledge Pathways and Options

As indicated earlier, there are several important modes of KM in the enterprise. In part, these modes reflect the knowledge pathways that are engaged. The operational objective of KM is to ascertain that the best available knowledge consistently is applied to knowledge work – to assure competent handling of business tasks and other situations, now and in the future. The objective is to ascertain that decisions and implemented actions will lead to good performance. In practice, one aspect of operational KM deals with transferring knowledge from subject matter experts (knowledge holders – KHs) to knowledge workers (KWs) or to automated systems. That is the case when KWs need existing expert knowledge and when new knowledge is created in the minds of experts and other KHS through learning, experience, research and innovation. Other aspects of operational KM deal with transferring knowledge form external sources to internal parties.
Figure 7 presents examples of knowledge transfer pathways from experts and KHS to KWs and automated business systems. Some paths are largely technology-based and result in creation of knowledge-based systems. Others are people-based with KHS and KWs in direct or indirect contact and increasingly supported by technology capabilities of many kinds. The examples of technology-based paths result in creation and use of many kinds of automated business systems (ABSs), decision support systems (DSSs) and knowledge bases (KBs). DSS and KB capabilities are used directly by KWs while ABSs are mainstays of information management (IM) in the enterprise and generally perform their tasks without human interaction. In addition,

![Diagram of knowledge transfer pathways]

**Figure 7. Examples of People-Based and Technology-Based Knowledge Pathways from Internal Subject Matter Experts and External Knowledge Sources to Knowledge Workers and Effective Performance of Business Tasks.**

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The examples in Figure 7 distinguish between *explicit* and *tacit knowledge*, which as indicated above are significant elements of IC. In addition (not shown) is the *embedded knowledge* in automated systems. People primarily possess knowledge tacit knowledge and cannot explicate more than a small portion of this knowledge – less that ten percent of relevant knowledge. However, people are able to use tacit knowledge and by example communicate it to others when working real-life tasks.

Explicit knowledge transfers require that KHS contribute what they can explain or demonstrate to capture and document pertinent knowledge. Explicit knowledge may be provided as narrative, videos, graphics, text, equations, ontologies, computer code and so on. Transferring explicit knowledge into successfully usable forms requires considerable resources and expertise in several fields beyond the target subject and conventional KM. Disciplines needed for this work include
advanced computer sciences and artificial intelligence (AI), cognitive sciences and ergonomics, branches of philosophy and management sciences. Specifically, expertise is required to elicitate knowledge competently, organize knowledge into structures and systems that facilitate effective use, create efficient technical systems and create powerful man-machine interfaces including sophisticated search features that facilitate efficient execution of business tasks. The human interfaces must match the cognitive approaches that KWs engage in during knowledge work. That will differ for KWs who deal with routine work and those who deal with more complex work as discussed earlier.

Other knowledge pathways include knowledge from external sources like research organizations, universities, consultancies and other knowledge holders. In some instances, that also includes collaboration and outsourcing knowledge building through targeted R&D projects. Yet other pathways involve the gradual inclusion of implicit knowledge into routines, practices, culture and traditions that result from all-present people efforts to improve organizational and work processes.

**Knowledge Diagnostics - the Least Understood Aspect of KM**

Not all KM initiatives are successful. They may fail to live up to expectations by having copied “best practices” from other organizations without addressing the enterprise’s actual business problems or opportunities. Hence, failed KM initiatives do not make significant impacts and may not be supported by people in daily operations. Most unsuccessful KM efforts are attempted without sufficient KM diagnostic efforts and many KM practitioners do not understand this area.

When diagnosing operating and other business problems, the understanding of the underlying factors and how to deal with them is dependent upon the understanding of situation-handling mechanisms. Competent knowledge diagnostics requires considerable expertise about the details of knowledge-related processes. The situation-handling model discussed earlier provides important support for organizational knowledge diagnostics by providing functional structure, definition and identification of the main process tasks and variables. As indicated in Figure 8, the model supports knowledge diagnostics by providing specific comprehension of intellectual work understanding with additional insights into KM solutions. Many such initiatives have failed.

Root-cause diagnosis of knowledge-related issues is both difficult and frequently overlooked although many advanced enterprises routinely pursue in-depth knowledge-related analysis and conceptualization. They conduct knowledge diagnostics of target situations and use this approach to develop candidates for KM intervention. However, most enterprises still pursue conventional symptom-oriented “industrial engineering” diagnosis and devise remedial solutions accordingly. When such enterprises pursue KM, they may utilize KM surveys and screenings methods such as knowledge mapping or they pursue KM based on what has been successful elsewhere without deep understanding of the knowledge-related mechanisms in the target situation.

Generally, knowledge-related problems or opportunities can only be observed indirectly and by people with relevant expertise. By their nature, these situations are different from traditional operational, tactical and strategic circumstances that can be measured and often are visible. Knowledge-related situations involve how people think instead of what physically happens. They deal with the intellectual – mental – processes that determine how a task situation is handled, i.e., how the situation is understood, options developed, which action is chosen and implemented.
Enterprises may lack the ability to diagnose situations from knowledge perspectives and instead limit investigation to physical or observable characteristics such as process flows, information flows and issues, resource availabilities, etc. Understanding of underlying knowledge-related mechanisms and processes are needed to analyze situations and to conceptualize KM interventions and actions. Target situations should be analyzed as critical knowledge functions (CKFs – see Appendix) where KM initiatives would make important changes to improve performance factors such as throughput by alleviating knowledge bottlenecks, operating problems and errors by providing expertise to perform tasks correctly, making possible new work by developing new knowledge and collaborating across silos and geographical boundaries by implementing social software infrastructure. CKFs may be important for several reasons.

Needed knowledge may be in short supply or not well-known at the point-of-use or in general. Knowledge may be vulnerable when only one or few people possess it and key people are in line for promotion, are close to retirement or plan to leave hence, resulting in a CKF problem. The CKF may have available proficient knowledge but have limited capacity when needed greater capacity only to be obtained by developing more experts. The CKF may be geographically separated from where expertise resides and therefore introduces limitations and so on. CKFs consist of five basic characteristics (more details in Appendix):

1. **Types of knowledge, expertise, or skill** required for effective task performance.
2. **Business use** – the operational purpose – of knowledge in support of the enterprise functional activity area.
3. **Constraints, vulnerabilities, or unrealized opportunities** resulting from insufficient knowledge or conditions that prevent knowledge to be utilized fully.
4. **Alternatives** for managing (i.e., improving or correcting) the CKF.
5. **Business value** of releasing the knowledge constraint or exploiting the opportunity.
Effective KM diagnostics on the personal level requires understanding of how personal knowledge and other intellectual capital (IC) assets are applied in a particular task environment to deliver competent and competitive work. On the organizational level, KM diagnostics requires analysis of how IC-related factors affect specific operations of business functions, the delivery and performance of products and services and so on. In general, KM diagnostics requires awareness of representative knowledge-related issues by having familiarity with symptoms and underlying processes such as:

- Quality problems caused by manufacturing workers who make minute mistakes when they misunderstand how tolerances affect field performance of product – or when they do not understand to identify when the parts they make have problems – or when they do not know how to repair parts with minor problems and end up using them anyway.
- Low personal productivity and unnecessary delays caused by apprentice insurance underwriters who are uncertain about how to proceed in nonroutine cases when they only possess routine and operational knowledge while lacking broader script and schema knowledge that would allow them to operationalize such knowledge to apply to different cases and situations.
- Wrong customer advice provided by service representatives who misunderstand customer situations or lack sufficient knowledge of the enterprise’s products, services and systems and procedures and therefore address customer situations improperly.
- Inappropriate design solutions by engineers who misunderstand product application requirements because of insufficient knowledge of how to apply technology in the target context.
- Misdiagnosis and faulty repairs by office machine and instrument technicians who make hasty conclusions based on assumptions derived from limited experience.

Other, more complex knowledge-related problems consist of situations such as where sales per employee fall below industry average or may be attributed to visible factors like excessive rework, equipment down-time, delayed parts supplies, or badly organized work. In-depth KM diagnostics may indicate that such difficulties are caused by knowledge-related problems of various types. Problems may be caused by lack of knowledge sharing between development and production departments, by operators lacking equipment diagnostics expertise, or by insufficient structural knowledge embedded in systems and procedures. Effective KM diagnostics builds on insights provided by many fields as indicated above, ranging from savvy management experience, organizational psychology, management sciences, cognitive sciences and advanced computer sciences, including artificial intelligence.

When considering CKFs from a knowledge perspective, the resulting KM alternatives often are not “natural.” That is, from conventional perspectives, they are not obvious or well-known as direct implications of customary responses. It is rare that the best option is to “train a replacement for the departing expert” and otherwise let business go on as usual as in the examples above. Often, in addition to introducing knowledge-related interventions, it may be desirable to simplify operations, combine tasks, shift responsibilities and tasks between different functions, or automate some tasks that previously were manual by leveraging the available knowledge and use of technological options.

Knowledge audits are often conducted in addition to knowledge diagnostics and often preceding it. A meaningful knowledge audit is not just a business needs assessment, but also a cultural evaluation and an examination of what knowledge is required, available, applied and
contained. In short, a knowledge audit is a practical way of getting to grips with "knowing what you know" and some of its tasks are to develop the business case for KM intervention.\textsuperscript{16}

\textbf{Some Knowledge Management Approaches}

Numerous effective KM approaches are available to the competent KM practitioner. Many prepackaged solutions can be acquired directly from KM software systems vendors. Some enterprises who have obtained such systems have been surprised to learn after the system is installed that not only have they received a KM system, they have also acquired the built-in operating practice and management philosophy that clash unproductively with their environment and culture. Other approaches, better tailored to the enterprise’s specific needs and environment can be obtained from consultancy organizations. Such organizations have a variety of specialties ranging from building knowledge bases (KBs) to creating knowledge-based DSSs and to implementing tailor-made ontologies. Again, care must be taken to build capabilities that fit the enterprise’s real needs and not acquire an off-the-shelf solution from a vendor that may not fit.

The KM literature in books and journals is vast and can be quite helpful. For example, among a total of twelve articles in a recent journal, three describe how to ensure KM initiative effectiveness, KM approaches to address the “Leaving Expert” issue and KM methods for new product development.\textsuperscript{17} Most KM practitioners take advantage of the available literature and should be encouraged to continue to do so.

\textit{People-Focused Knowledge Management}

The largest area of deliberate and systematic KM is by necessity people-focused since KM initiatives support people who conduct cognitive work. As such, it deals with several areas that traditionally are not perceived to be part of KM, often because of the traditional operational perspectives, while excluding strategic and tactical perspectives that are as concerned with IC-related capabilities as with current tools and practices. Hence, broad and long-term KM includes initiatives such as succession planning, hiring and firing, education and training, establishing “corporate universities,” to name a few.

Explicit people-focused KM addresses cognitive support of people who are engaged in knowledge work.\textsuperscript{18} Its perspective, in addition to technology-based KM, comes from cognitive and social sciences and emphasizes how single individuals, teams and whole organizations can be strengthened by KM. PFKM approaches include broad areas like the learning organization (LO) and knowledge sharing methods like communities of practice\textsuperscript{19} (CoP) within the enterprise and networks of practice\textsuperscript{20} (NoP) among professionals in different, at times competing, enterprises.

\textit{Technology-Based Knowledge Management Capabilities}

Practitioners are aware of numerous technology-based KM approaches. Knowledge bases (KBs) of different architectures and many types of decisions support systems (DSSs) are well-known. DSSs

\begin{itemize}
  \item[\textsuperscript{16}] For discussion of knowledge audits, see <http://www.skyrme.com/services/kmaudit.htm>.
  \item[\textsuperscript{18}] Wiig 2004 op cit.
  \item[\textsuperscript{19}] Wenger 1998.
  \item[\textsuperscript{20}] Brown & Duguid 2000.
\end{itemize}
may range from simple guides to more complicated rule-based or case-based reasoning (CBR) systems to advanced search support applications that use semantic or natural language processing (NLP) technology. Other KM approaches include technological-based KM support infrastructure, social software including wikis (discussed below) and knowledge mining in data bases. However, care with systems design and implementation must be taken since technology-based KM solutions are difficult and fail much too often.  

**Knowledge Management Support Infrastructure**

Infrastructure to support KM includes capabilities for collaboration, organizational memory, knowledge transfer and intellectual capital management. Within these areas are technical facilities such as video conferencing facilities, document morgues, e-mail and wikis, social software, ontologies, search engines, knowledge base structures and portals. KM infrastructure also includes KM-related policies such as established enterprise approaches for lessons learned capture and reuse, accessing experts, structured collaboration practices, sharing in intellectual property after inventions and many others.

**Knowledge Management and Social Software**

Social software covers a wide range of support applications. Among these are collaborative software and groupware, instant messaging and wikis for conducting exploratory multilogs and knowledge sharing. Effective collaborative software and groupware are sophisticated Internet or intranet applications that may support multiple windows for participant video and voice communications, for video displays, PowerPoint and other presentations, for sharing text and graphics and for private notes and documents. Collaborative software has become important for communities of practice, team collaboration and for briefings, distance education and other multiple-party functions in the enterprise, in networks of practice and in the society as a whole.

One area of importance here is the use of wikis. From one perspective, wikis let people work together online similarly to how they work face-to-face by having threaded discussions to explore ideas or deepen understanding of a knowledge area. Another use of wikis is the enterprise-dedicated creation and continually updating of KBs by any approved participant such as is happening with Wikipedia.

**Knowledge Management and Advanced Search – Semantic Search**

Advanced search procedures have great value to knowledge workers who are engaged in intellectual and conceptual work. These procedures may rely on pre-indexed information that may be organized by semantic principles. They may also – and increasingly important – operate using NLP on unstructured materials such as reports and document text in archival data bases or in the public domain. The latter search procedures may use dictionaries of synonyms and phrase relationships or powerful natural language processing (NLP) to perform semantic and even concept-based searches.

Recent Knowledge Management Advances

Several advances in KM are able to deliver new levels of support for knowledge work. Among these, we highlight the following examples:

- Development and application of targeted ontologies\(^\text{22}\) that describe knowledge categories and elements and the relationships between these. Using ontologies as the organizing structure improves the general understanding of task knowledge and increases the application value of KBs and DDSs. As indicated above, ontologies are important for development of better data dictionaries by ascertaining that the relationships between knowledge and information are defined and coordinated.

- Incorporation of natural language processing (NLP) to provide extended capabilities for applications such as knowledge mining in unstructured data bases, advanced concept-based search procedures, machine translations, man-machine interfaces, speech recognition and many more.

- Use of wikis for CoPs, NoPs and team collaboration support and general knowledge sharing and creative and innovative exploration.

- Data visualization in multi-dimensional and other complicated data bases.

Advanced Computer Sciences and Artificial Intelligence

Artificial intelligence (AI) has contributed many approaches to advanced computer sciences and indirectly to KM. That has often been done in combination with other disciplines, such as cognitive sciences, library sciences, social sciences and engineering design. Among AI-originated methods are natural language processing (NLP), advanced concept-based text and image search methods, trainable neural nets for automated systems and decision support systems (DSSs), evolutionary computing are among many others.

Evolutionary Computing

Evolutionary computing may be particularly interesting since it generates good solutions to difficult problems, often in ways that elude experts. For the method to be applicable, the problem realm needs to be modeled in one form or another and the problem performance must be measurable. A simple overview of the technique is shown in Figure 9 where the “generate-and-test” method illustrates one approach for computing to proceed with evolution by generating a new configuration using modeled principles and then evaluating the effectiveness of the proposed configuration. Approaches to automatically generate proposed configurations may be based on randomized search, on hill-climbing methods or other strategies. Evolutionary computing has been successfully used to design satellite antennas for NASA and propellers for ships. It has also been used to generate project schedules for very complicated projects.

\(^{22}\) For more on ontologies, see Fensel 2001 and Wikipedia 2007.
A KM System Example - Lessons Learned Systems (LLS)  

Whenever exceptional situations occur, there are opportunities for learning valuable lessons. But to be learned, such opportunities need to be captured, described, preserved and made accessible for future use. In this way, new knowledge is built to enhance the ability to act intelligently when confronted with difficult or unusual situations that may have been experienced before.

Learning from experiences with undesirable or desirable situations is an integral part of the Learning Organization (LO) and it is part of continued improvement and keeping ahead of one’s competitors. Unfortunately, important learning opportunities are often not analyzed and captured. At best, they have been ephemeral and become part of the hazy workplace folklore and what could have been learned is mostly forgotten only to be rediscovered after similar situations occur again. Thus, important situations may prompt later comments such as: “It happened before and we should have known ..!”

Knowledge professionals can help capture learning opportunities by establishing structured approaches that become part of the organization’s normal operating practice. Such approaches must lead to insightful analysis of the original situation by taking advantage of in-depth information of what it was all about. Equally important, the analysis must be based on detailed understanding and knowledge of the processes within which the situation took place.

Effective and powerful approaches to learn from noteworthy problematic or opportunistic situations are used with success in many enterprises. Soon after the situation has occurred, a small team of two to four (at times more) is assembled to analyze and describe what happened and what can be learned. Team members must collectively have in-depth familiarity with the situation, its setting and context, its value or cost impacts and the management and business role of the function within which the situation occurred. If the situation is of a technical nature, theoretical expertise must also be represented.

Figure 9. The Evolutionary Computing Process and the Associated General Generate-and-Test Procedure.  

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An effective lessons-learned approach must be supported by a structured protocol to make experiences widely available and to guide the process and document the situation and associated learnings. Each organization might develop special approaches to reflect their culture, operating environment and methods for storing and disseminating lessons-learned. Typical protocols include:

- Summary of lesson learned
- Situation description
- Description of lesson learned
- Codification of lesson learned using the enterprise ontology or general structural description
- Why was the situation valuable or how could it be handled better?
- Members of lesson learned team

In addition, several factors facilitate the entry of new experiences and provide motivation to consult the lessons-learned system:

- Institute organizational requirements to learn from all significant situations and reinforce these requirements with managerial and budgetary support and monitoring.
- When notable events have taken place, be quick to organize situation-specific lessons-learned teams with requisite expertise and familiarity of the situations. Teams consist of from one to 4-6 members and must work fast -- they are one-time task forces, not committees!
- Provide a structured approach to document and codify lessons-learned – preferably ICT-based
- Organize repositories to cumulate knowledge from lessons-learned. These must be managed to organize and prioritize learnings, ascertain quality and cull obsolete knowledge. But they must not become bureaucracies!
- Develop efficient practices to share lessons-learned and make them available through appropriate networking and by other means

The lessons-learned team should be assembled quickly after it has been recognized that a significant situation has occurred. The team should work fast and deliberately -- at times, this process might take a fraction of a day by one person. For more complex situations of greater importance the process may take a week or longer by four or more people, some of who may be outsiders with special expertise. It is important that an LLS be created to organize, compile and distribute the descriptions of lessons-learned as these are received. When a formal “Knowledge Representation” is used to codify the lesson learned, competent knowledge professionals may assist with the knowledge elicitation and codification process.

**Final Observations**

This white paper furnishes the background of a framework for knowledge-related work and organizational activities that provide the basis for deliberate and systematic pursuit of KM for the competent enterprise. The nature, management, creation and utilization of intellectual capital (IC) within any organization are complex and involve and affect how the organization is organized and operates – business-wise and as a social system – how people work, how technology is applied and
what its capabilities and resources are. Hence, for KM to be effective, it needs to be practiced with multi-disciplinary perspectives and capabilities.

For competent performance in the global knowledge economy, enterprises need broader KM practices than often have been the case. Traditionally, KM has focused on support of current operations with approaches such as communities of practice (CoPs) and technology-based KBs and DSSs. Whereas that focus supports effectiveness of the enterprise’s daily operations and therefore is crucial, the scope of KM in advanced enterprises has expanded to include support for strategic and tactical considerations to ascertain that tomorrow’s IC assets and capabilities will be adequate.

KM practices continue to improve. New computer science technology and practical experiences provides more powerful systems that support knowledge workers better than ever before. Cognitive sciences gives us better insights into how people use knowledge to perform work – from simple, repetitive routine work to dealing with complex challenges that require innovation and new knowledge. Management sciences and microeconomics provides insights into the value of KM initiatives and their priorities. All of these inputs make KM increasingly powerful and helpful in the quest to make the enterprise more competent.

From the experiences of many enterprises, it has become evident that deliberate and systematic KM will only be pursued with determined managerial will. Whereas short-term perspectives are important for effective operation, long-term perspectives guide KM investments to secure the future intellectual capital required to sustain the operational, tactical and strategic effectiveness required in tomorrow’s competitive environment.
References


Appendix – Critical Knowledge Functions (CKF)

1. The **type of knowledge (or expertise or skill)** that is involved in performing a function or task. Examples:
   - Expertise in operating a chemical reactor during both routine and unstable operating conditions.
   - Proficiency in diagnosing automotive and truck diesel engine failures.
   - Skill to design miniaturized compressors for extreme environmental conditions.
   - Competence in underwriting group health insurance for small companies with hazardous operating conditions.
   - Understanding of how to deliver outstanding customer service.

2. The **business use** of that knowledge. Examples:
   - Provides the capability to produce high quality specialty chemicals with minimal process interruptions and just-in-time.
   - Enables enterprise to decide least life-cycle costs solutions for repairing diesel powered trucks for use within the organization.
   - Supplies the competence to design, build and market high margin, long life and reliable compressors allowing the enterprise to become the market leader.
   - Allows company to offer competitive health insurance with acceptable risk-return characteristics.
   - Creates opportunities to develop highly competitive customer loyalty.

3. The **constraint** that prevents the knowledge to be utilized fully, the **vulnerability** of the situation, or the **unrealized opportunity** that is not taken advantage of. Examples:
   - There are too few knowledgeable operators available and as a result many reactors are not run well (Constraint).
   - The master diagnostician only has time to diagnose 25% of the trucks with problems and this leads to improper and expensive repairs that take too long (Constraint).
   - “Our design knowledge is superb compared with competition and we can therefore consider to offer a broader line of highly specialized custom designs to create a larger and more profitable market.” (Opportunity).
   - The expert will retire at the end of the year and we have not trained anyone to replace her (Vulnerability).
   - The expert customer service representatives are not motivated to share their expertise with others and as a result we have an average customer service that falls below our objectives (Opportunity, constraint and vulnerability).

4. The **opportunities and alternatives** for managing (i.e. improving or correcting) the CKF. Examples:
   - Creating a Knowledge-Based System (KBS) allows limited capture and automation of expert operator knowledge on reactor operation and makes it available around the clock to all operators. Also, elicit the expert operator’s concepts for sharing through discussions with the other operators. (Alleviate constraint.)
• Training additional engine diagnosticians by letting them work as apprentices to the master diagnostician for several months. (Alleviate constraint.)

• Introduce new product lines of compressors that are custom designed for new environments that previously were not served well and therefore provide the opportunity to break into new markets. (Exploit opportunity.)

• Elicit and codify accessible portions of the expert’s knowledge before she retires. Video-tape the expert as she tells stories to other underwriters about how she dealt with challenging cases. Also, after retirement, for a time retain expert as a consultant to shadow and help the new underwriter. (Minimize vulnerability.)

• Change the reward system to, in part, provide bonuses to all customer service representatives as a group instead of only recognizing the top performers. Also provide recognition for helping and sharing knowledge. (Exploit opportunity, alleviate constraint and minimize vulnerability.)

5. The (incremental) value of releasing the knowledge constraint, minimizing the vulnerability, or taking advantage of (exploiting) the opportunity to use knowledge for operation, services, products. Examples:

• Improved operations – leads to decreased chemical manufacturing costs, increased revenues, increased profit, increased market share.

• Reduced repair costs and time leads to increased net profit and reduced capital investment (due to higher utilization factor of vehicles in fleet).

• Additional high performance compressor designs for new applications make possible profitable market expansion.

• Continued underwriting expertise allows company to continue its lucrative business in the niche market.

• Improved customer service delivery competence increases customer service acceptance and loyalty.