

Application of Knowledge Management in Public Administration

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Knowledge Management (KM) plays several roles in Public Administration. Each role serves specific constituencies and purposes and is implemented differently. Jointly, they build society's intellectual capital (IC) to improve the effectiveness of public and private decision making and situation handling. Four Public Administration KM areas are considered: (a) Enhance decision making within public services; (b) Aid the public to participate effectively in public decision making; (c) Build competitive societal knowledge and IC capabilities; and (d) Develop knowledge-competitive work force. Numerous KM approaches are adopted by states, cities, and other public entities to serve these purposes. Some depend on information technology (IT). Others focus on education, person-to-person communications, or use of the media. Still others rely on targeted help-lines and other kinds of direct assistance. Most efforts are created to address specific needs. Only few consider the needs for a broad, deliberate, and systematic management of knowledge and IC building. Examples of these approaches and perspectives are discussed. The premise for applying KM is that among many factors, effective and intelligent behavior depends on having appropriate understanding as well as being adequately informed. Traditionally, emphasis has been placed on the importance of "informed decisions." Less emphasis has been placed on the understanding required for appropriate sense making, options creation, decision alternative selection, implementation planning, and execution and how to achieve needed insights.

Introduction

Viability and success of any country or society is largely a function of its leveragable resources. These range from depletable natural resources, strategic geographic location, capability of its people, and resources like intellectual capital. Whereas the private sector may play dominant roles in developing and leveraging these resources, effective public administration is crucial for governing and facilitating the desired results.

Public administration in any society is exceedingly important and complex. It affects most aspects of society in one way or another. Its approach and effectiveness determine culture, quality of life, success, and viability of the society it serves including pace setter, planner, implementer, educator, peacemaker, and disciplinarian, all with different emphases depending on the society's culture and agendas. A competent public administration with sufficient capacity and influence can provide for a great society. An incompetent or dysfunctional one can lead the society into severe decline, even ruin.

To be successful in fulfilling its functions in a democracy, the citizenry must also cooperate in many ways and have confidence in its capabilities, directions, and actions. Successful participation by citizens and their confidence depend largely on their broad understanding of, and agreement with actions by public entities and acceptance of immediate and long-term implications of those actions. An ignorant citizenry is a poor public policy partner. A vital aspect of the society's success is the knowledge that its citizens possess, that is made available to its public servants, and that is embedded in structural and other intellectual capital assets that can be leveraged internally and in the global market.

Public administration shares the responsibility to assure that its local area has ability to maintain or improve the quality of life it intends to offer its citizens. From a knowledge, or societal IC point of view, this implies participation in building and leveraging its society's IC to obtain the necessary economic foundation. It also implies long-term responsibilities to foster development of a competitive work force that can compete in the regional and global economies. These issues are well known to public administrators. However, the past has not offered opportunities to address them with powerful and systematic approaches. This is changing. The broad field of knowledge management (KM) introduces new options, capabilities, and practices that can impact and assist public administration to great advantage. It becomes a new responsibility for Public Administration to manage knowledge to strengthen public service effectiveness and improve the society it serves.

The goals of KM are to improve the effectiveness and sustained viability of the enterprise – be it a commercial corporation, a part of society, a country, or a single individual. KM must be fully aligned to the enterprise's central objectives. For public administration in a democracy and from a knowledge perspective, the KM objectives may be expressed as the intent to provide:

- Effective public administration services and functions to pursue and implement the public agenda in all areas. Public services should address issues and challenges relevantly and competently and be timely and consume minimal resources. Public services should also be able to deal appropriately and expeditiously with unexpected challenges and disasters.
- A stable, just, orderly, and secure society. A major aspect of this objective is to prepare citizens, organizations, and public agencies to be effective policy partners – to create sound public opinions – to engage in public debates and policy formation – to participate in processes to conceptualize, plan, decide, and implement public actions – to observe society policies – and to provide general support for the administration.
- A society that provides its citizens an acceptable level of quality of life through building, maintaining, and leveraging commercial and public intellectual capital (IC).
- A prosperous society that is competitive in the regional and global economy through developing its citizens to be competent knowledge workers and its institutions to be competitive – in all required disciplines and industries.

Comprehensive Knowledge Management

Over the last decades, the roles of knowledge and understanding for organizational performance have become clearer. Earlier, much managerial emphasis was placed on observable work. Later

is was expanded to include the role of information. Now, it is shifting to include knowledge. It has always been understood that know-how and expertise influence quality of work. However, the knowledge focus has tended to be on the individual and not on systematic considerations¹ of broader work processes or knowledge mechanisms within organizations. There has been little focus on invisible work, particularly on how workers think and utilize knowledge when performing tasks. Consequently, rationalization efforts which do not consider knowledge may decrease performance after some time instead of producing desired results.

Recent changes in business emphasis are driven by many factors. They include an increasingly sophisticated and demanding market place, deeper insights into business functions, and greater understanding of knowledge intensive work and how people think, learn, and use knowledge – i.e., cognitive sciences (Brown & Duguid 2000, Damasio 1994 and 1999, Halpern 1989, Nonaka & Takeuchi 1995, Klein 1998, Schön 1983, Wiig 1993). Gradually, leaders have started to focus on managing knowledge deliberately and systematically. Knowledge management (KM) has emerged to bring approaches for creating and leveraging intellectual capital (IC) into the business equation (Allee 1998, Böhme & Stehr 1986, Reich 1991, and Wiig 1994 and 1997). At this time, there is a preoccupation with the use of information technology (IT) as the way to manage knowledge. On the other hand, IT is used extensively to support KM although many information management tools are marketed as being “Knowledge Management” tools, which they arguably are not. It is important to realize that knowledge is distinctly different from information and that KM and information management are not the same.

Figure 1 provides a perspective – a dynamic model – of the role that knowledge plays in enterprise performance. In this model, four principal factors are indicated: Enablers; Drivers; Facilitators; and Mechanisms. Solid arrows indicate performance-influencing relationships. Broken arrows indicate some dominant relationships between factors. Knowledge and other intellectual assets are the principal enablers of performance. They provide means to establish the proper course, content, and quality of actions. Drivers provide energy and impetus to act. Facilitators provide ‘lubricants’ to reduce friction that work against actions. (The current state of affairs – ‘What Is Happening’ – is provided by ‘Class A’ information). Mechanisms consist of the functional elements that are manipulated – the processes that are operated – to produce actions.² Traditionally, principal attention has been focused on mechanisms – the components of the system that implement actions determined by the drivers, enablers and facilitators. The knowledge perspective makes it possible to shift the focus to components that determine the effectiveness of “what” the actions should be, i.e., what should be implemented.

Traditionally, knowledge has been managed implicitly and without the benefit of a specific focus. Deliberate and systematic KM – comprehensive KM is undertaken to support enterprise viability and success. It pursues explicit, systematic, and enterprise priority-driven approaches to develop a distributed, non-bureaucratic enterprise-wide practice that is part of each person’s work life. Comprehensive KM practices include deliberate efforts to:

¹ Systematic approaches, when applied to societal processes, emphasizes applying systems theory to deal with interconnectedness, dynamics (effects over time), parallelisms, and nonlinear behaviors of the society’s processes.

² See Wiig (2000b) for further discussion of this model.

1. Identify which knowledge (IC) needs to be created and maintained – including the IC desired for market exploitation and expertise that needs to be available at points-of-action for delivery of desired competitive work products and service paradigms.
2. Create, transform, and provide (learn and deploy) the required knowledge and ascertain that it is continually renewed.
3. Ascertain that all available knowledge assets (ICs) are diligently leveraged wherever appropriate through use or exploitation.
4. Govern knowledge management-related processes and relationships by providing enterprise-wide support, infrastructure, and leadership.

Incremental KM, on the other hand, tends to almost arbitrarily identify and pursue a knowledge-related action, often as an extension of an already occurring activity – an incremental improvement on ‘business-as-usual’ and may not focus on ascertaining that the knowledge assets are applied.

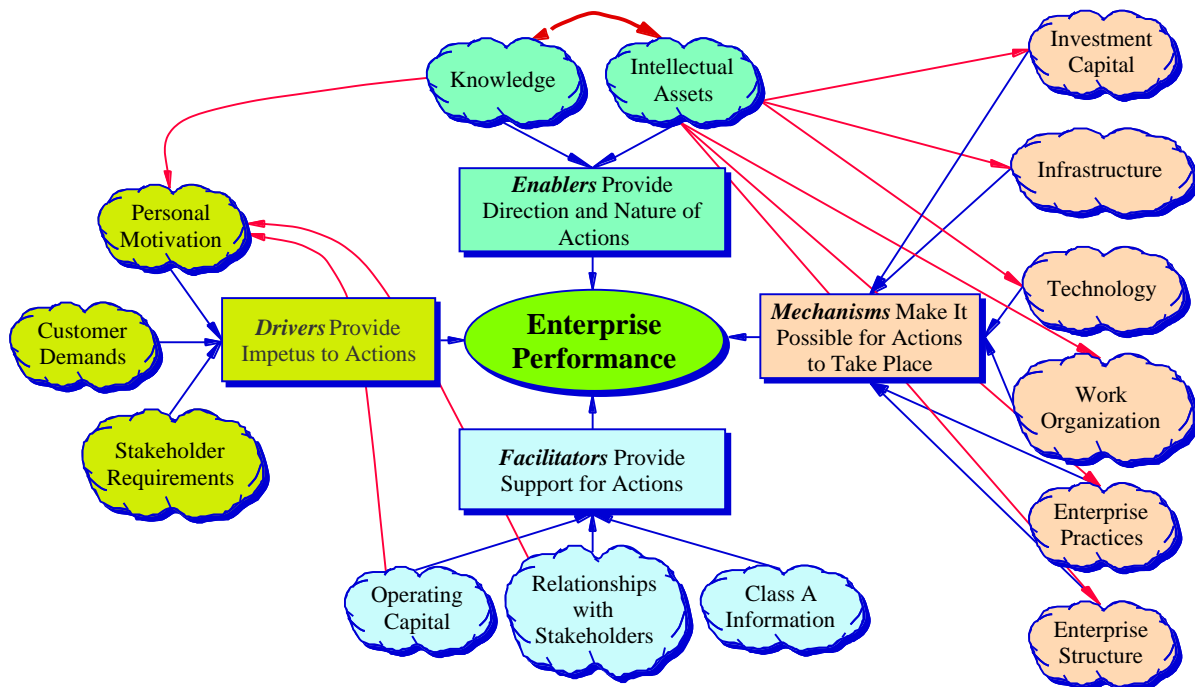


Figure 1. A Perspective of the Role of Knowledge in Enterprise Performance.

Enterprises that pursue broad and systematic knowledge management – ‘comprehensive KM’ – find that they pursue several sub-practices that in total contribute to the overall success. They are vigilant in their focus on making knowledge work effectively as the chief enabler of enterprise success. These sub-practices include efforts to:

- Focus the KM vision and practice to align with enterprise direction – by identifying intended enterprise business direction to ascertain that knowledge-related factors receive appropriate attention and are well maintained.
- Provide effective governance for the KM practice.

- Promote synergistic orchestration culture (see Appendix) by fostering a knowledge-supportive culture –including safe environment, ethical and mutually respectful behavior, minimal politicking, collaboration, and a common focus on delivering quality work without delay – i.e., “getting the right thing done quickly and with as little fuss as possible!”
- Provide shared understanding – of enterprise mission, current direction, and individual roles to support the enterprise and of individual’s own interest.
- Practice accelerated learning – by pursuing a broad range of knowledge transfer activities to ascertain that valuable knowledge is captured, organized and structured, deployed widely, and used and leveraged. The impetus is on making important knowledge flow rapidly, in proper quantities, in well-represented and effective ways, and to all valuable destinations.
- Educate employees – by providing opportunities to learn professional, craft, and navigational knowledge and metaknowledge, and by providing information and other resources necessary to deliver quality work products that satisfy work requirements and service paradigms.
- Provide opportunities – employees must be placed in situations where they have opportunity use their capabilities.
- Give permission – employees must be provided safe environments in which to do their work and have understanding of how far they can improvise and “stretch” enterprise guidelines and policies to serve individual situations and customers.
- Foster motivation – employees must be motivated to act intelligently – ‘to do the right thing’ – by being provided with understanding and emotional acceptance of how their actions will be of value to stakeholders, the enterprise, and most importantly, to themselves.
- Create supportive infrastructure capabilities - including extensive application of IT.

Comprehensive KM can be created by implementing any of a large number of potential activities. Figure 2 provides examples of a few such activities with indications of how they fall into four main functional areas. These areas are:

- Governance functions to direct and support KM-related efforts throughout the enterprise from enterprise perspective and goals.
- Staff or infrastructure functions that support KM objectives and individual activities of many kinds including supporting capabilities like special expertise teams, institutions, and technological facilities.
- Operational functions to obtain and create knowledge and to capture, organize, distribute, and manipulate it.
- Functions to realize the value of knowledge-related investments through understanding of how to leverage knowledge in use, in products and services, in patents and technology, or in other kinds of structural knowledge such as systems and procedures.

Organizations that pursue comprehensive KM recognize that enterprise strategy is decided in the boardroom by deliberate ‘decisions-in-the-large.’ However, strategy implementation takes place through the minute ‘decisions-in-the-small’ that people make as part of their daily work. Since strategy and business direction is implemented in the field and on the factory floor, comprehensive KM must spread understanding of what the enterprise intends to happen.

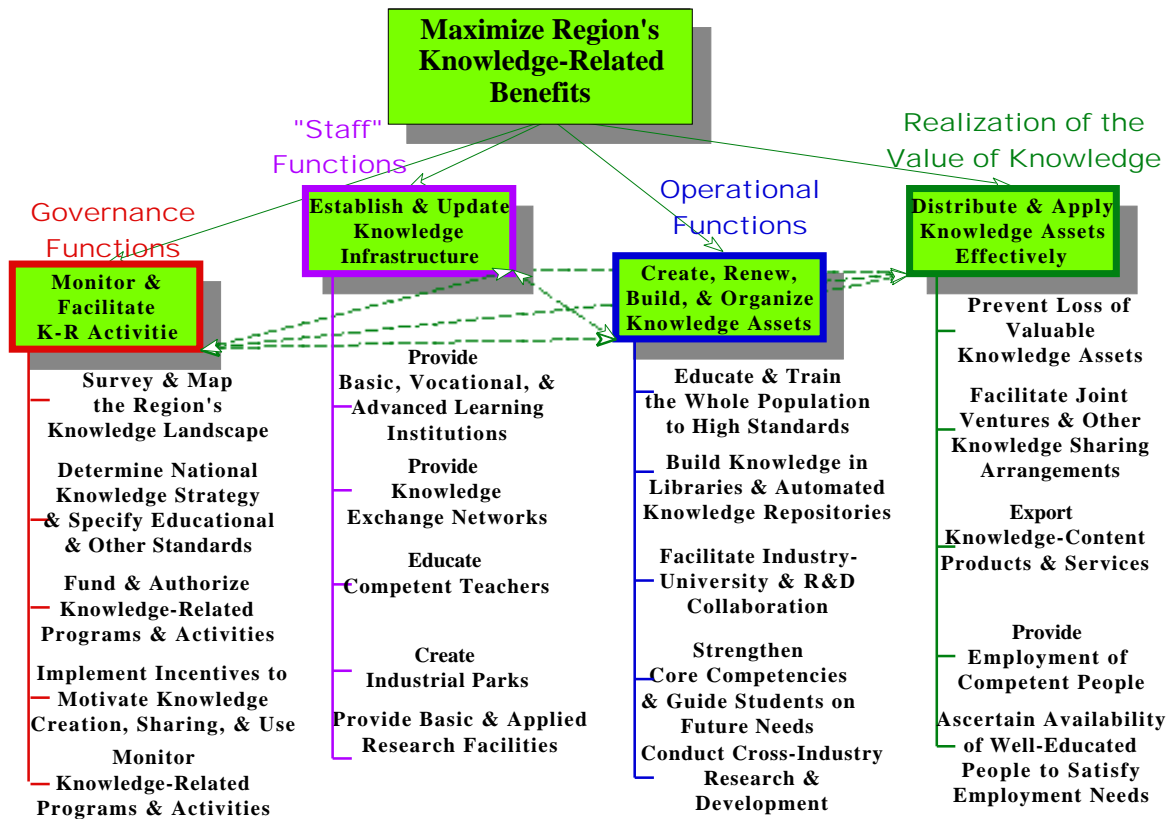


Figure 2. Examples of Knowledge Management Activities in Four Functional Areas.

When pursuing comprehensive KM, a constant requirement is to identify and work towards the expected benefits. This is particularly important since “managing knowledge” itself in reality is impossible – it is only possible to manage knowledge-related actions and conditions. To a large extent, KM involves intangible benefits that impact the visible and tangible performance of the enterprise – the society – through complex pathways. Under such circumstances, it is easy to lose sight of the value of KM and therefore to lose support and fundings unless the benefits of the actions are made clear.

Public Administrators’ Role in Societal Knowledge Management

The functions of public administrators in the modern, democratic society is complex. In societal KM it may at times be difficult to balance the sharp edge between: (a) having deep – or special – insights into how to proceed and (b) involving the public and special needs groups in a collaborating process. Ideally, but unrealistically, civil servants should have top expertise or collaborate with experts with the most advanced state-of-the-art understanding in their fields. Public administrators must provide initiatives, leadership, and coordination to bring to bear the most effective approaches and to ascertain that society as a whole is served appropriately. While at times being experts, they should also be lead facilitators and KM moderators.

The role of guiding and governing the region's agendas for public knowledge and IC falls to the public administrators. A separate, but small Public Administration entity should be created for this purpose and its function must be supportive, innovative, and collaborative. It must not be overly prescriptive and "dictatorial." This office needs to operate on several levels. Part of its work needs to be on the policy level with responsibility to coordinate KM activities in accordance with the society's goals and objectives. It must also communicate with legislatures and other public agencies to secure the resources required to pursue the knowledge agenda. Another aspect of its work requires collaboration with citizen groups and the business community to facilitate joint programs, determine capabilities, opportunities, needs, and constraints (CONC) analysis.³ These requirements lead to needs for specialized expertise in several areas consisting of public policy, KM backgrounds such as Artificial Intelligence and Advanced Computer Sciences, Knowledge Engineering, Cognitive Sciences, Social Sciences, Library Sciences, and Philology or Linguistics.

Often, introducing KM practices into public administration brings out an issue of major impact. Effective KM practices rely on sharing understandings and insights to encourage collaboration and innovation for the purpose of arriving at the best obtainable course of action. However, that can only be achieved with openness and candor that is not feasible in or foreign to many societies. In almost all situations where that is the case, there are opportunities for introducing selected aspects of KM to serve specific purposes.

Assuring Competent and Effective Public Services

As indicated above, the success and viability of any society is dependent upon how well its public services are provided. The quality and effectiveness of public administration services are influenced by many factors. Organizational structures, responsibilities, capacities, information, civil servant personal expertise, and knowledge available otherwise are some of the factors that affect the intelligent performance desired from the enterprise. Among these, knowledge is a major enabler – the basic resource that governs the nature and directions of actions. Without adequate knowledge, even when given the best information, actions will be based on ignorance and will be arbitrary and ineffective. ***Consequently, it is of paramount importance to manage knowledge for the purpose of making public services act with understanding.*** However, knowledge alone is not sufficient. Primary factors are indicated in Figure 3 with examples of the active KM activities they support to deliver the desired resulting effects.

From a knowledge perspective, organization and division of work within and between public entities reflect experience – know-how and understanding – that have been embedded in systems, procedures, and work practices as 'structural' IC (Edvinsson & Malone 1997, Roos et al. 1998, Stewart 1997 and Sveiby 1997 discuss IC in general and explain its structural and personal components). The expertise that public servants possess reflects their personal knowledge obtained through education, training, performing work, and in other ways. In addition,

³ Capabilities, Opportunities, Needs, and Constraints (CONC) analysis is similar to Threats, Opportunities, Weaknesses, Strengths (TOWS) analysis but provides different perspectives.

knowledge-based performance support systems (PSS), expert networks, and other aids provide important complements to assure that the best knowledge will be available at the point-of-action.

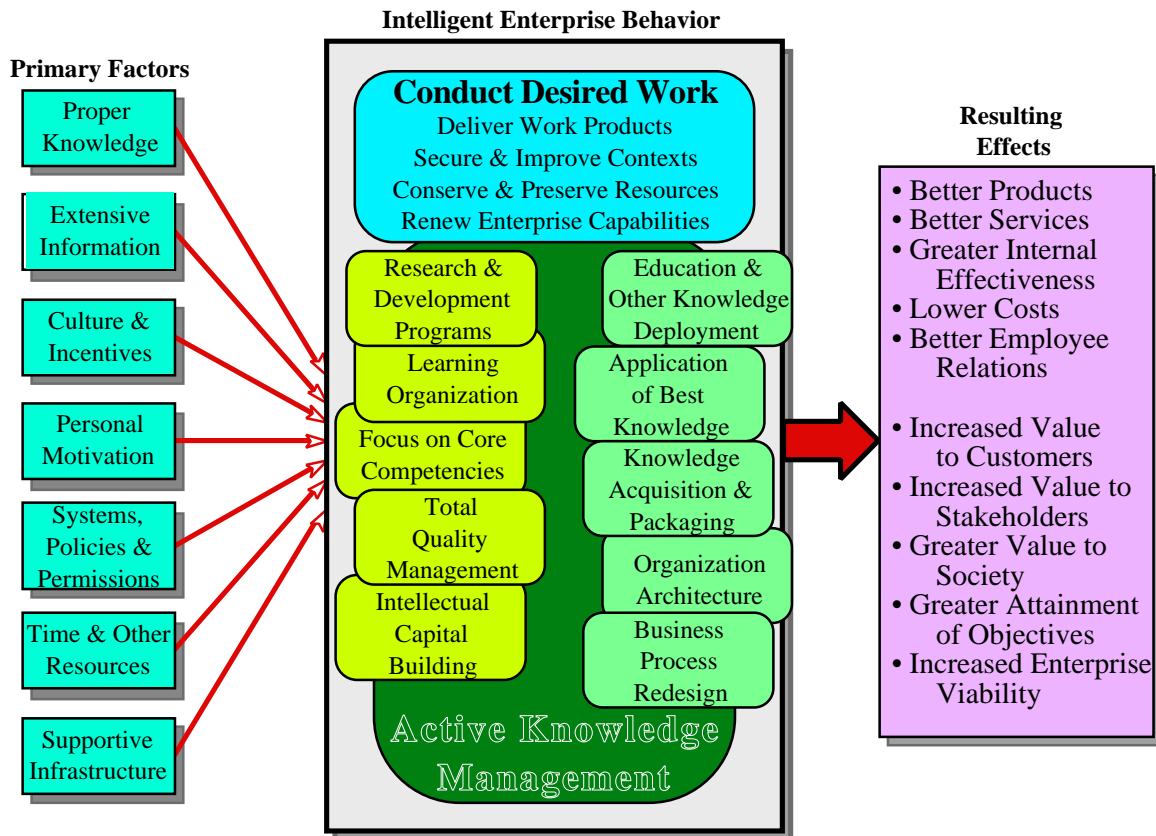


Figure 3. Primary Factors Needed to Deliver Desired Work .

Creating and maintaining competent public services is not simple. As for other organizations, and as indicated in Figure 3, the overall effectiveness of public agencies depends on individual effectiveness based on intelligent behavior by its people, their motivation, and their freedom to act appropriately. It also depends on the suitability of policies, support systems and infrastructure, and organization of work, to name some aspects. Again, a major factor that influences these aspects is knowledge. That includes the expertise and understanding that individuals can command to perform immediate work. It also includes knowledge embedded in design and creation of policies, procedures, organization of work, work aids and tools, and infrastructure. Comprehensive KM provides approaches to improve most of these aspects. For example, KM methods are used to build expertise in people and to influence their motivation through increased understanding of the value of their own roles to society – and very importantly, to themselves. In general, application of KM approaches developed for other organizations are highly relevant for public service organizations.

Managing knowledge to provide effective public administration is not new. Building personal expertise in public servants is traditional. Training programs, qualification examinations, certifications, and other approaches have long been used successfully. They help to develop and

control competence, ascertain that the public will be served well, and that public interests and agendas are pursued appropriately. However, there is always room for improvement. Modern comprehensive KM build upon such established practices by providing additional capabilities and approaches. Some of particular interest are similar to commercial endeavors and are described in the Appendix.

In all these areas, several KM approaches may be implemented to support more effective performance. The selection of which options to implement and when, become functions of the combined utility of expected performance change, available resources, support of the overall KM practice, broader enterprise needs, and other factors. Among all the KM approaches that are open to public administrators to manage knowledge – or to create a comprehensive KM practice within their organization – the following examples should be indicated (see Appendix for further definitions):

Examples of Governance Activities

- Create a vision for what KM will do for the region's Public Administration with particular focus on the benefits and impacts that might be expected from the KM practice.
- Survey and map current state of knowledge at all relevant agencies and in areas of specialization with associated evaluation of capabilities, opportunities, needs, and constraints (CONC analysis).
- Provide KM-related incentives, guidelines and policies, and reflect desirable KM practices in employee evaluations.
- Create a "Synergistic Orchestration" environment within each agency by changing work practices and culture drivers.
- Based on contingency and disaster plans, identify educational and other knowledge-related steps that need to be initiated.
- Monitor and govern effectiveness of Public Administration KM practices.

Examples of Infrastructure Activities

- Build IT infrastructure to support effective KM. This includes traditional information management since quality information is an absolute requirement for effective public administration. Other required features include:
 - ✓ uniform e-mail environment for all of Public Administration,
 - ✓ groupware for collaboration,
 - ✓ specialized knowledge repositories and data bases,
 - ✓ intranets for each agency,
 - ✓ IT-based disaster-related educational and information capabilities for public servants and the population-at-large
 - ✓ business-to-business ("b2b") capabilities, and
 - ✓ technological implementation capabilities such as development of advanced performance support systems (PSS) with automatic reasoning and natural language understanding and handling.
- Build communities of practice within agencies and networks of practice between agencies and with the community-at-large (Wenger 1998, Brown & Duguid 2000) to strengthen collaboration, knowledge sharing, learning, and innovation.
- Build Public Administration educational capabilities.

- Develop Lessons Learned Systems.
- Create KM professional core staff.
- Build Knowledge Administration office.
- Develop and apply knowledge sharing practices.
-

Examples of Operational Activities

- Educate public servants in topic knowledge and metaknowledge such as critical thinking and enterprise navigational knowledge.
- Capture innovations, lessons learned, and other knowledge, transform the captured knowledge into suitable formats, and transfer into knowledge repositories.
- Transfer expertise from exceptional performers to other knowledge workers.
- Transfer tacit knowledge into structural knowledge.
- Motivate and reward public servants for sharing knowledge and for using others' ideas and expertise to improve their work.
- Create and educate special action disaster response teams to support regular Public Service functions during problem periods.
- Form educated collaborative liasons with private entitites and public agencies in preparation for dealing with earthquakes, typhons, floods, draughts, epidemics, social unrests, and so on.

Examples of Value Realizing Functions and Benefits

- Collaborate extensively – within agencies, between agencies, with members of the public, with industrial and business partners, with special interest groups.
- Practice “always use best knowledge” habits supported by incentives, guidelines and policies, and reflected in employee evaluations.
- Place public servants in positions where they can use their expertise to the best advantage of society.
- Allow public servants to use their expertise through innovation and improvising within desirable limits.
- Deliver higher quality public services consistently.

Prepare Effective Policy Partners

Public administrators participate in the process of making the public understand the need for and direction of public activities, programs, and projects. Traditionally, that has led to informing the public about planned or proposed actions and in some instances, holding hearings or using other interactive mechanisms to engage in constructive dialog. Unfortunately, these mechanisms are to a large extent marginal in their effects. A reason is that these methods do not alter the deep understandings which individual citizens possess of proposed actions and their insights therefore remain limited. They are faced with a situation of being engaged in “informed decision making” while having limited understanding of the implications that can be expected from the actions. Much resistance against public actions results from public misunderstanding or ignorance. Also, many inappropriate public actions may be approved by a public that does not understand its negative sides.

Public governance is more effective when citizens have understanding of directions, options, issues, and opportunities and share value systems and 'models of the world' with public administrators.⁴ No society can expect all its citizens to attain deep insights and fully shared perspectives. Similarly, nowhere will the complete citizenry be fully educated or of one mind. There will always be legitimately different opinions, knowledge-sparse misunderstandings, and value-based disagreements. To make the desired difference, communications must be effective and preferably closed loop with feedbacks through dialog (Wiig 1995, 327-334).

In Public Administration dealings with the public, many problems are caused by the wide difference in mental models and resulting understandings that exist in the general population. These often are different from the insights of public servants who may have learned a great deal about public action subjects, although at times from narrower perspectives than those available in the public-at-large.

KM methods provide opportunities to prepare the citizenry to be more effective policy partners – for conceptualizing, planning, deciding, and implementing public actions as well as for providing general support. To be effective policy partners, citizens need to have breadth of knowledge and understanding of consequences. Among KM approaches that are available to public administrators to assist the public to become more effective policy partners, the following should be indicated.

Examples of Governance Activities

- Create visions for how KM can assist making the public effective policy partners.
- Provide guidelines and funding for public communication and dialog.
- Develop collaborative relations with media and other communications channels.
- Obtain fundings and legislative support for public communication and dialog.
- Govern the public policy partnering process.

Examples of Infrastructure Activities

- Create web-sites for public actions, programs, projects to provide information and in-depth descriptions of proposed and ongoing actions.
- Create publicly accessible and well organized information repositories and libraries.
- Create state-of-the-art interfaces (portals) for public information and knowledge repositories to facilitate effective access and use by citizens and interest groups.
- Build capabilities to create effective education and information materials.
- Provide citizens who do not have computers with public facilities for all to have access to public intranets.

Examples of Operational Activities

- Provide deeper communications of proposed actions. Communications should ideally explain the principles and expected positive and negative implications to the public. In-depth

⁴ Mental simulations and evaluations of outcomes are based on projections of expectations for behaviors using mental models of processes in the world ('models of the world') and values held by individuals or groups of individuals. Agreements such as public support for official projects are often based on shared mental models between the public and administration. Misunderstandings between two parties often results from significant differences in the models of the world that the parties hold in their minds.

analyses and projections of principles and implications may often be too expensive. Yet, in most situations much more is known than what is communicated and that should be changed.

- Utilize all media channels to provide frequent and reliable communications about public activities and related effects that concern the community.
- Facilitate networks of common interest throughout the community for the purpose of building joint understanding as well as to be able to conduct dialogs.
- Maintain publicly accessible data bases on all non-restricted aspects of public administration. Equip these data bases with powerful search facilities and to the extent possible, automatic reasoning capabilities such as natural language understanding.
- Author communications to the community using methods such as hypertext linking to related topics and documents, educational materials, and simulation capabilities to permit members of the public to explore expected effects for scenarios they relate to.
- Design communications to cater to different cognitive styles by for example issue the same content in different formats such as a written report, a CD video, a cartoon booklet, and a multi media document with hypertext links.
- Create learning materials to be distributed through different channels to provide understanding of public issues ranging from health and environmental issues to communications about potential future work force needs – all where public decision participation is required in some form.

Examples of Value Realizing Functions and Benefits

- Engage citizens and interest groups in creative collaboration for potential and new public actions.
- Obtain and incorporate as required feedback on propositions and actions from the public.
- Obtain citizen participation in public decision making (elections, etc) with greater understandings – by people who have obtained greater knowledge as a result of knowledge-related information activities.

Build and Leverage Public and Private Intellectual Capital

The viability of success within a country or local area are dependent upon its leveragable resources. In the present public and private intellectual capital (IC) assets of different kinds create significant opportunities. Public administration has many opportunities to influence both creation and leveraging of IC within its region.

In today's global economy technology is important. Creation of technology and research parks or knowledge flow clusters is of considerable importance for building environments where world class expertise and congregate and provide environments of considerable synergy.

Knowledge-related actions often need to be complemented with other actions to facilitate the desired results. For example, to attract outside industry that can benefit from a well educated work force, tax or other import-export restrictions may have to be eased.

On a national level, public administration influences knowledge-related mechanisms for building and leveraging IC assets in many ways. These include patent policies and legal support for IC value realization and protection enforcement. Other public administration interventions include

international trade agreements and targeted support of individual export or import contracts. On both national and local levels public projects provide direct support for creation and leveraging public and private IC. Nations and local areas benefit from knowledge-related activities in several ways. Some of these result in increased trade and economic activity. In particular, developments of local or regional IC assets such as world-competitive expertise and knowledge-based products can be expected to result in valuable economic and trade changes. Some examples of benefits from public support to promote development of expertise IC include:

- Financial sophistication and expertise lead to ability to support local businesses to become world players. External institutions have also been attracted to form regional financial centers.
- Commercial expertise leads to increased trading with existing and new partners, locally and externally.
- High technology expertise provided successful products and services that leads to export of goods and services. It also has led to realization in the emerging work force of areas of potential professional success.
- Basic technology and industries operated with world-class expertise leads to export potentials and ability to supply domestic industry with effective products that in turn made them more productive.
- Medical expertise leads to attractive environment for outsiders to conduct business within the region. It also lead to a healthier and able domestic work force.
- Scientific expertise in areas such as agriculture leads to improved agricultural products and greater yields.
- Tourism management expertise leads to quality tourism services with potentials for increased tourism activity

As is well-known, larger economic activity leads to increased employment, trade, and area payroll with associated positive economic impacts. However, as for other areas of societal developments, many of these impacts take time to be realized. Many mechanisms are available to public administrators to create IC assets directly or to facilitate their creation in the private sector. As is the case in the private sector, KM priorities and strategy need to be governed by the desired direction of the enterprise that is served. Also, IC asset development must be predicated upon available resources and current developments in the public and private sectors.

Governments frequently allocate resources to create capabilities to obtain specific, often short-term results. While providing the desired primary results, these actions often develop highly valuable secondary IC assets and capabilities. Some of the mechanisms that build IC assets directly or indirectly in this way include:

Examples of Governance Activities

- Trade and business policies and agreements
- Create a vision for public involvement in building and leveraging intellectual capital – what is involved, what will result, and how it might be achieved.
- Make strategy, tactics, and short-term plans for building and leveraging IC in accordance with present and expected future public objectives.

- Obtain legislative support and funding for the IC program.
- Promote an IC building and leveraging environment.
- Foster industry/government/educational institution collaborations in support of the IC program.
- Create new or adjust the charter of existing specialized IC promoting agencies – such as “Institute of Patents and Copyrights,” “Institute of Science and Engineering,” and “Institute of Management and Commerce.”
- Provide financial supports in the form of grants and tax incentives
- Govern the process of creating and leveraging IC from the public interest perspective.

Examples of Infrastructure Activities

- Build public R&D facilities – defense laboratories, fishery institutes, agricultural research stations
- Build public educational institutions – universities, trade schools
- Build public and quasi-public organizations – utility companies, telecommunication organizations
- Build communications infrastructure – telecommunications in particular with Internet connections and backbones
- Build tailored technical infrastructure capabilities including specialized architectures for knowledge bases and other repositories, knowledge acquisition systems, intelligent access to knowledge and information.
- Build technology and innovation parks
- Build libraries and knowledge repositories
- Build educational institutions and programs

Examples of Operational Activities

- Undertake publicly supported benchmarking programs
- Award contracts and conduct public research and development (R&D) to learning organizations, private institutions, and public laboratories.
- Conduct knowledge exchanging conferences.
- Using conventional and high-technology channels, publish (or facilitate private publishing) relevant news, scientific and trade journals, and technical and scientific reports.
- Commence special purpose panels to advance selected IC-related topics.

Historic Examples of Value Realizing Functions and Benefits

- Financial sophistication and expertise led to ability to support local businesses to become world players. External institutions have been attracted to form regional financial centers.
- Commerce expertise led to increased trading with existing and new local and external partners.
- High technology expertise provided successful products and services that led to export of goods and services. It also has led to realization in the emerging work force of areas of potential professional success.
- Basic technology and industries operated with world-class expertise led to export potentials and ability to supply domestic industry with effective products that in turn made them more productive.

- Medical expertise led to attractive environment for outsiders to conduct business within the region. It also led to a healthier and able domestic work force.
- Scientific expertise in areas such as agriculture led to increased food production, increased export of specialized agricultural products, and increased wealth in farming areas.
- Tourism management expertise led to quality tourism services with potentials for increased tourism activity

Public and private IC assets that create value come in many forms. Presently, much attention is given to technology and related IC assets. However, India, Sweden, and even the United States realize considerable societal value from their exports of films and popular music. Public and private agricultural and other food-related research institutions create societal value through making possible products that have global demand. Financial centers attract economic activities from the outside that in turn generate ancillary services and provide employment and further economic activity.

Develop Capable Knowledge Workers

Any society is dependent upon the capability of its work force. If a society has an uneducated or unmotivated work force, it can only rely on its natural resources to be successful, and even that is questionable. In today's global economy where knowledge and other ICs determine competitiveness, a major objective is to develop and maintain the ability of its citizens to perform skilled and knowledge-intensive tasks. From the societal knowledge perspective, Public Administration needs to play an active role also in this area. To be effective, its role must be based on a clear, but flexible, vision of what should be achieved, how it should be undertaken and which societal results should obtain.

The process of developing a competent work force requires time. Several perspectives should be kept in mind when considering how to envision and manage the development process. These broad perspectives include:

- The **Transverse Perspective** of work force requirements and development across industries and societal functions considers development of citizens to be capable and have competitive expertise – in all disciplines and industries required. This perspective needs to consider the breadth of all areas such as: Agriculture and fisheries; Tangible goods industries; Service industries; Educational functions; Research institutions; Civil services; and Defense functions.
- The **Longitudinal Perspective** starts with infants throughout childhood, schooling, and preparation of trade workers and professionals. This perspective needs to consider all the stages of personal developments such as: Prenatal conditions, Infant rearing; Kindergarten impacts; Grade, middle, and high school education; Trade school preparation; Associate degrees; University education; Post-graduate work; Industry training; and Life-Long Learning programs and opportunities.
- The **Political Process and Resource Allocation Perspective** considers society's objectives, public opinions, interest group influences, and the time, communication, and other realities of political processes. This perspective also considers society's priorities, funding capabilities, and availabilities of public and private resources relevant to work force development.

- The **Methodological Perspective** considers knowledge-related practices, methods, and activities that can be undertaken to achieve the desired goals.

Public administration has many options available for developing the work force. Some options provide relatively quick results without great investments. Others, such as public education can require extensive financing over one or two decades before the results are available. In most of these areas public administrators must provide initiatives, leadership, and coordination to bring to bear the most effective approaches and to ascertain that society as a whole is served appropriately. Particular options include:

Examples of Governance Activities

- Create vision for long-term work force development program.
- Map current state of knowledge at all relevant age levels and areas of specialization with associated evaluation of capabilities, opportunities, needs, and constraints (CONC analysis).
- Develop public policy for long-term, regional-wide development program for building knowledgeable, skilled and competent work force for all expected industrial and business areas.
- Develop educational guidelines and standards. Efforts in this area must be undertaken in collaboration with society-at-large, educational leaders, and leaders from industry and business.
- Obtain legislative support and funding for public education.
- Provide public funding for educational facilities and programs.
- Provide public funding for scholarships and for special education for gifted and disadvantaged students.
- Collaborate with business and industry for projection of future needs, apprenticeship programs, etc.

Examples of Infrastructure Activities

- Develop curricula, tests and proficiency requirements, text book content requirements, and models (role models) for effective teaching.
- Build needed educational capacities – new and expanded institutions.
- Provide IT infrastructures for primary, secondary, and tertiary schools, trade schools, colleges, and universities and integrate it with Internet, scientific institutions, and relevant business and industry.
- Educate and re-educate teachers and educational administrators to implement the public education contents and paradigms.
- Develop Life-Long learning capabilities.
- Develop mechanisms to communicate expectations for future employment needs to the public.
- Provide students at all levels with personal computers or equivalents.

Examples of Operational Activities

- Develop and deploy educational materials – books, advanced technology-based and other types.
- Develop and distribute educational role models for classroom teachers, students, and the home.
- Develop and operate Life-Long Learning (“LLL”) programs for all citizens.

- Transfer theoretical and practical topic knowledge, metaknowledge, critical thinking, and Internet and society navigational knowledge.
- Develop and operate general e-based public education.
- Educate, educate, educate.

Examples of Value Realizing Functions and Benefits

- Provide competent work force to industries and businesses by being able to place appropriately skilled and educated people in valuable positions.
- Deliver world-competitive products and services with a competent work force.
- Satisfy industry and business employment requirements in terms of number of educated and skilled people.
- Decrease unemployment by providing competence to a larger fraction of the population.

Broad Public Administration Knowledge Management Practice

In any region, Public Administration entities have broad responsibilities for governing and facilitating public aspects of operations and life of public and private organizations and individual citizens in pursuit of societal objectives. When considering knowledge-related issues, such responsibilities cover not only internal Public Administration knowledge-related functions. They also cover and extends to governing and facilitating other knowledge-related and affected areas, such as preparing effective policy partners, building and leveraging the region's IC, and building and maintaining a capable and competitive workforce. Furthermore, the responsibility also extends to creating and governing the overall vision, perspective, and strategy for the society's general KM practice.

As indicated above, to pursue an effective KM practice a small KM office must be created within Public Administration. Proper staffing of this office, in Public Administration as well as in private business, has proven important. The conceptual leadership for KM must in part reside in this office. The office staff should have considerable expertise in KM matters. However, broad KM practice must ultimately be the responsibility of each agency and each civil servant within that agency. Hence, the function of the KM office will be to balance between being supportive and prescriptive. The office must maintain the broad vision for comprehensive KM and facilitate its adoption across all functions. It must secure shared resources that individual agencies cannot substantiate. It must provide methodological leadership and ensure common standards to allow interoperability, uniform access, and maximize opportunities for collaboration and sharing. The KM office itself should be kept small with related KM personnel distributed throughout the different agencies.

Starting any new practice – and a comprehensive KM practice is not different – requires a well thought-out, deliberate, and small and targeted beginning with clear understandings of resulting benefits. However, it is also important to have a flexible blueprint of the broad vision to guide the efforts. Initial and later KM activities should serve as building blocks and contribute to creating the larger KM practice. It therefore is important to identify the desired path of activities and resulting benefits that are planned to build a broad and comprehensive KM practice that

reaches all intended areas and parties and produces the capabilities and results that are envisioned. Some KM governing activities that may be considered to start a

- Identify people who are conceptual drivers for comprehensive KM and rely on them for guidance.
- Develop vision for the public KM practice within the region.
- Create the KM office function.
- Create knowledge landscape map for the region covering the overall responsibility area of Public Administration with special emphases on delivery of public services, preparation of the public as effective policy partners, building and leveraging public and private IC, and development of citizens as capable knowledge workers – all considering capabilities, opportunities, needs, and constraints.
- Develop knowledge and IC-related policies and obtain legislative commitments and fundings for the overall program.
- Govern the overall knowledge and IC – related practice.

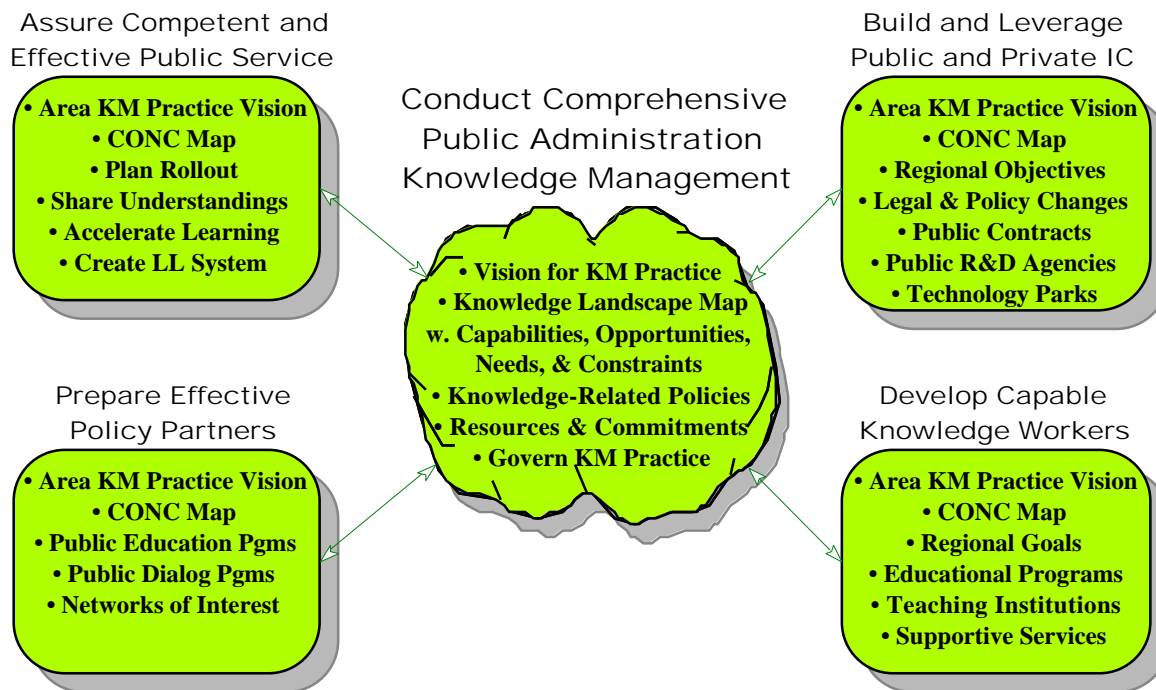


Figure 4. Elements of Public Administration Knowledge Management Practice.

Illustrative elements of Public Administration KM actions are indicated in Figure 4. As the KM vision is built, it is important to keep a clear overview of which activities need to be undertaken for which purpose and which ones may serve many purposes as indicated in this figure. Beyond the general activities, the IT-related support activities and infrastructures are important. They serve vital functions, are complex, costly, and often take time to design and implement. Therefore, they require separate considerations and some may be illustrated as in Figure 5 where the joint infrastructure activities are separated from activities that serve particular purposes. In

addition, it may be desired to identify implementation sequences such as those that should be considered for implementation in Round 1, Round 2, and so on.

Building the infrastructure for a Public Administration KM practice requires extensive effort. In addition, technology advances rapidly in many areas and new approaches and capabilities appear regularly. In this environment, it is important to create a flexible IT architecture and maintain a flexible plan to provide desired versatility. This often requires creating many infrastructure elements that will serve most intended purposes but are scheduled to be replaced within the overall planning horizon.

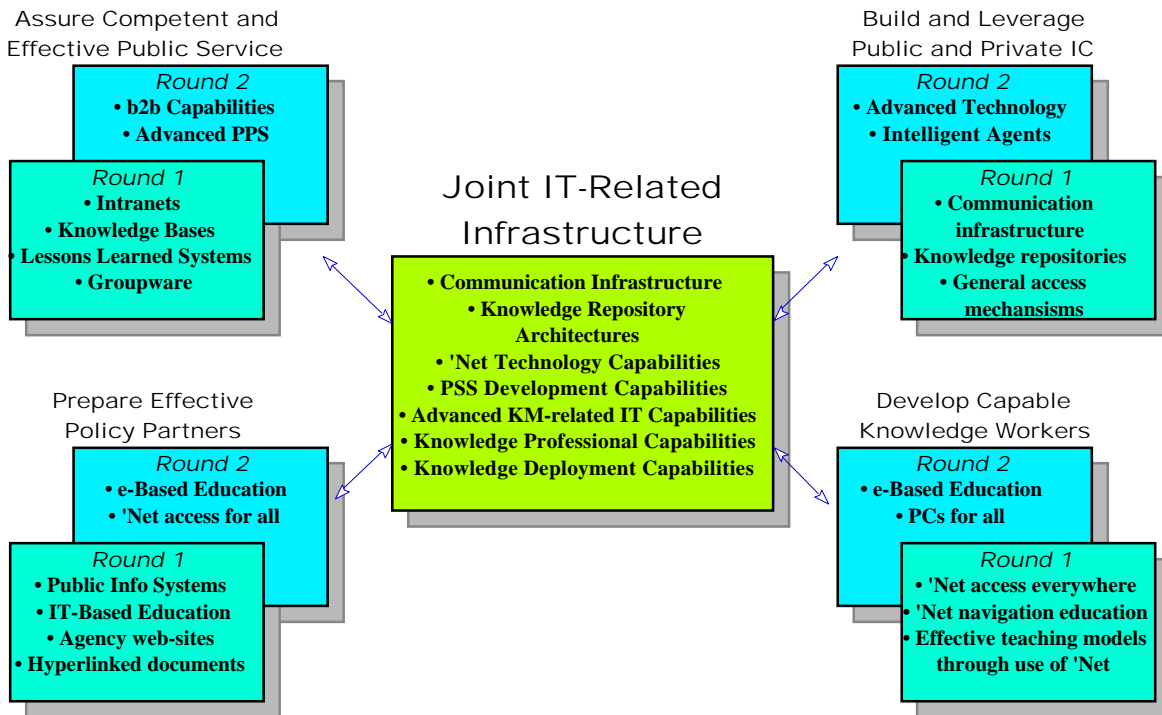


Figure 5. IT-Related Elements of Public Administration KM Practice.

Concluding Comments

In many respects Knowledge Management (KM) is in its infancy and under constant development. We do not have good insights into how knowledge – associations, understanding, and thinking, in particular – is used by people to perform work. Nor do we understand how to transfer knowledge – cognitive skills – effectively from one person to another or how to transfer conceptual and tacit knowledge from personal domains to structural knowledge within organizations. Technology-based KM tools are generally immature and in rapid development. Nevertheless, the KM practices, approaches, methods, and tools that exist today are useful and valuable and have assisted organizations to benefit through improved effectiveness. New insights and advancements make implementation of KM practices more focused, less resource intensive, and more effective. These developments are expected to continue for some time.

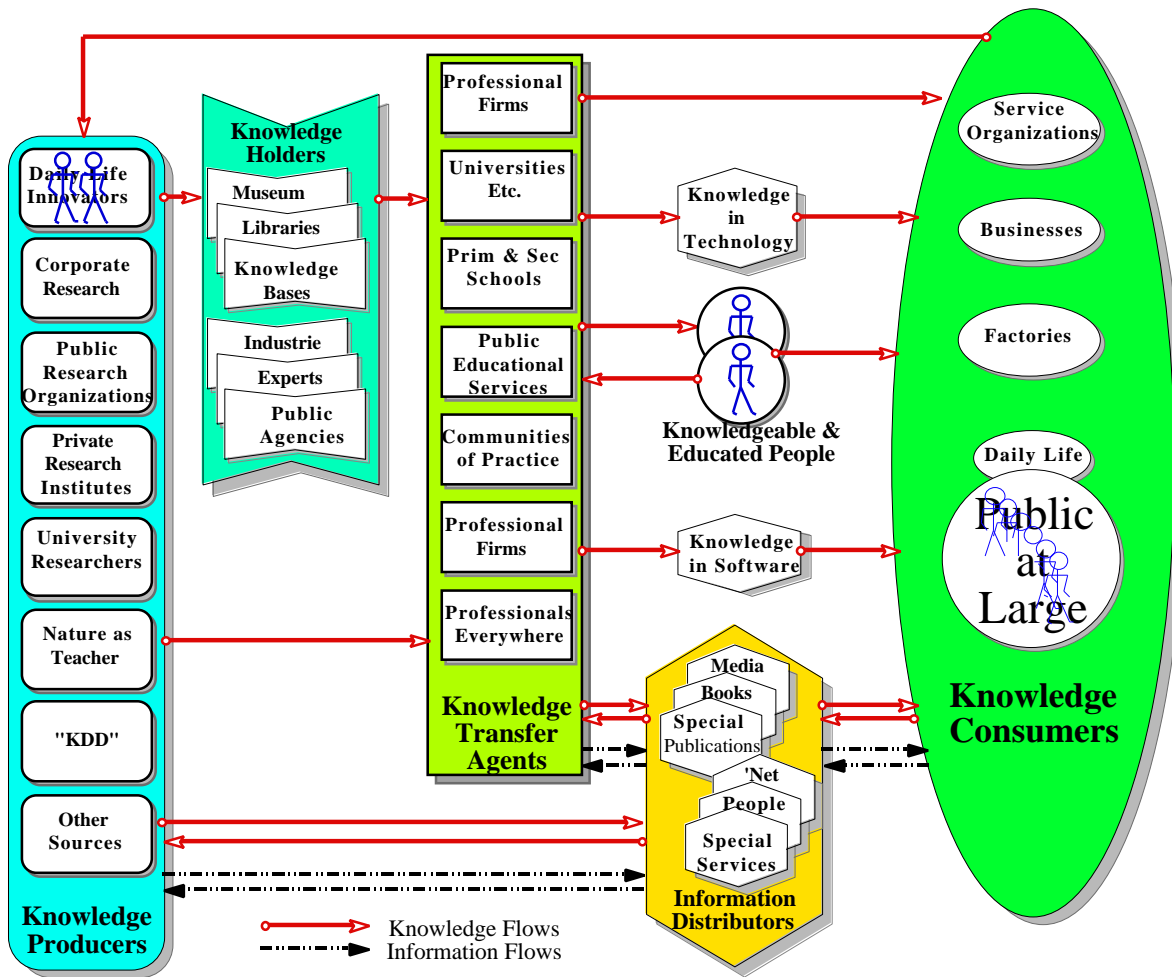


Figure 6. Examples of Societal Knowledge Entities and Related Flows.

In the modern society, applications of KM practices supported by KM methods and tools, including IT-based tools, have become important to pursue societal goals with success. Public administrators in most nations and regions have started to implement selected approaches to achieve well-defined objectives and this trend appears to be accelerating as experience is gained and new insights of valuable applications of KM are shared. There is an emerging understanding that for KM to reach its potential, KM practices need to be broad and comprehensive – each agency, department, and individual need to incorporate KM considerations into their daily work life.

One might suggest that all aspects of society consist of entities that behave in ways that are determined by the knowledge possessed by people or that is embedded in a variety of ways in systems, procedures, technologies, and computer-based systems, just to name a few. In particular, we find knowledge-related entities that include knowledge producers (sources), knowledge holders, knowledge transfer agents, knowledge and information distributors, and knowledge consumers. Among these entities are pathways of knowledge flows as for example illustrated in Figure 6. This “knowledge system” is in reality operating as a living organism with

bottlenecks and inefficient mechanisms. It therefore is important to maintain an overview and a vision for how the overall system should operate in the modern, competitive society.

In particular, the need for comprehensive KM within and in support of public administration is important. KM plays a central role to make public administration function more effectively. More importantly, comprehensive KM governed by public administrators in support of societal goals can provide broad benefits that allow the society to prosper and increase its viability by making its people and institutions work smarter.

Appendix

In the following a small selection of KM practices and methods are outlined. Further discussions of additional approaches can be found in the literature (Cortada & Woods 1999, Liebowitz 1999, Sveiby 1997, Thierauf 1999, Tiwana 2000, Wiig 1995 and others). The practices and methods included below are:

- Create Synergistic Orchestration Environments
- Map Knowledge Capabilities, Opportunities, Needs, and Constraints
- Measure Intellectual Capital and Create an Intangible Asset Monitor
- Change Cultural Drivers
- Create Collaborative Work Practices
- Foster Communities and Networks of Practice
- Conduct Knowledge Cafés
- Capture and Transfer Expert Know-How
- Capture and Transfer Expertise from Departing Personnel
- Capture Decision Reasoning
- Lessons Learned Systems
- After Action Reviews (AAR)
- Outcome Feedback
- Expert Networks
- Knowledge Discovery from Data (KDD)
- Performance Support Systems (PSS) and Knowledge-Based System (KBS)
- Build and Deploy Knowledge Bases
- Information Technology Tools for Knowledge Management

- **Create Synergistic Orchestration Environments** – When an enterprise builds and orchestrates an internal practice to deal systematically and deliberately with knowledge by having people share insights and seek assistance from one another, a new and open culture emerges. People open up and discuss difficult issues, emerging ideas, and tentative opportunities with one another. They take ‘mental’ risks that would be unthinkable in conventional environments. They seek collaboration to achieve better results quicker, and build upon ideas of others and let others build on their own ideas. By opening up to new approaches and perspectives, and by building on the capabilities of others instead of only

relying on their own, they expand their ‘action space.’⁵ As people expand action spaces, and become more effective through capable collaboration, the enterprise becomes more effective. Complex tasks are addressed better and faster, and innovations abound and make the enterprise more capable and able to engage in activities that previously were infeasible.

- **Map Knowledge Capabilities, Opportunities, Needs, and Constraints** – Mapping (auditing -- surveying -- determining the general conditions of) the enterprise’s knowledge landscape provides insights for enterprise governance and other high-level functions and is often a top-down effort. In addition, knowledge landscape mapping (KLM) can provide important details for focusing on particular areas that need management attention. It consists of auditing knowledge-related conditions, programs, activities, capabilities, assets, etc. to identify Capabilities, Opportunities, Needs, and Constraints (CONC) of the overall knowledge situation and of potential future developments.
- **Measure Intellectual Capital and Create an Intangible Asset Monitor** – Provide overview by auditing the intangible assets of the enterprise with focus on the intellectual capital. Create a permanent IC management capability by implementing an intangible asset monitoring system for regular updates. <<http://www.sveibytoolkit.com>>
- **Change Cultural Drivers** – by introducing more effective communication practices, peer reviews, and specifics such as incentives, guidelines and policies, and corresponding employee evaluations to influence the behavior of people within an organization.
- **Create Collaborative Work Practices** – Many factors affect capability to collaborate. Some of these are associated with attitudes. Others are associated with understanding and knowledge. Yet others are associated with compatibility and sharing views, thinking styles, and backgrounds. A set of important factors for being able to collaborate include: Sufficient, complementary, and diverse expertise for creativity, versatility, and flexibility; Shared and well understood goals and objectives; Shared knowledge to mutually understand the situation’s needs and nature; Personal security and knowledge that collaborating is “safe”; Understanding of others’ expertise to accept the value and relevance of their potential contributions; Mutual respect, tolerance, and trust; Compatible work styles and ability to work together
- **Foster Communities and Networks of Practice** – by facilitating collaboration and socializing by people with similar or identical responsibilities within an organization (Community of Practice). The purpose is for these individuals to share experiences and insights, collaborate to find innovative solutions applicable to their daily work. Networks of practice are formed by people with similar functions from different organizations.
- **Conduct Knowledge Cafés** – Knowledge Cafés is a term used for group sessions where a number of people (from a small number to several hundred) are assembled to discuss implications of some topic that affects them and their organization. Typically, the

⁵ Action Space – The domain that lie within the perspectives span and the boundaries that circumscribe the outer limits of the actions that the person (or enterprise) is comfortable to operate within.

knowledge café is conducted by presenting the topic and its background to the group. This presentation is followed by brief (5-15 minutes) discussions small groups (five or fewer persons) of the implications and what they may mean for the participants. The groups are then scrambled and discussions are repeated – often for four or five cycles before summaries are collected. Often, continued informal discussions are encouraged for days or weeks..

- **Capture and Transfer Expert Know-How** – are used to communicate concepts, judgments, and thinking by exceptional performers, experts, to other knowledge workers to help them develop improved knowledge to perform better.⁶ One approach uses a KM professional to assist experts to identify and characterize their associations, concept hierarchies, mental models, content knowledge, and metaknowledge through observing experts at work and in simulated situations. Using this material as illustrations and examples, the experts communicate directly to other workers. They explain their approaches, thinking and perspectives for handling routine and particularly, nonroutine, situations and engage less experienced workers in discussions and explorations. This approach allows these workers to learn by building and internalizing new knowledge – they build mental models in the form of operational models, scripts, schemata, and general abstractions.
- **Capture and Transfer Expertise from Departing Personnel** – is a valuable practice when competent people retire – or are promoted. Many approaches are used. For example, some use trained observers who document routine and semi-routine work in job descriptions, reports, or video recordings. Others utilize ‘self elicitation’ by writing or audio or video recording explanations of their expertise. Others use KM professionals to elicit and document pertinent knowledge. Still others use apprenticing or shadowing to learn on-the-job. Shadowing is particularly useful when the expertise covers a highly variable domain such as for managers, internal consultants, ‘trouble shooters,’ and similar broad fields.
- **Capture Decision Reasoning** – is very important but rarely performed. It involves identifying and making explicit the reasons why a particular decision was created and chosen and other pertinent aspects regarding the situation. Capture of what is behind the decision involves identifying the context and circumstance of the situation, the perspectives that dominated the which options were considered and rejected with reasons noted. The context is described
- **Lessons Learned Systems** – are provided to support existing work and capture new knowledge. Lessons Learned systems (LLS) include procedures for sequestering the persons directly involved when a notable situation has occurred. LLS consist of several elements including: (a) Individuals involved in the target lesson learned (LL) situation; (b) Procedures for the capture process; (c) Repository for initial, unedited capture information; (d) Editing process; (e) Approval process for including LL into final knowledge base (KB); (f) Resulting KB consisting of all LLs; (g) KB access methods (such as Case-Based Reasoning – or CBR); (h) User community that will access and use the LLs in their work; (i) Information

⁶ Transfer of cognitive skills has proven difficult. Under the best of circumstances at most ten percent of expert knowledge can be elicited and transferred during a project period. See Anderson, 1981 and Singley & Anderson, 1989.

technology environment in which LLS is implemented. The target LL situation may be a solved problem, a preventable mishap, a recognizable opportunity, and so on. LLS procedures call for quick assembly of participants to capture all relevant information, often in a predefined, structured format to make such knowledge available when required. The LLS may use CBR technology to store and locate applicable knowledge in the form of representative cases to provide guidance when a new situation arises (Wiig 1995, 295-304).

- **After Action Reviews (AAR)**⁷ – were first developed by the armed forces to learn from experience by identifying what the mission was, how it was approached, what went right, what went wrong, what the situation was relative to what was expected, and which learnings should be recognized. Three questions drive the AAR method: What happened? Why did it happen? What should we do about it? The purposes of AAR are to: Improve the accuracy and detail of feedback available to sector leaders and employees; Identify collective and individual strengths and how to leverage them; Identify collective and individual deficiencies and how to correct them; Reinforce and increase the learning that took place during a business activity; Increase interest and motivation; Guide the individuals and groups towards achieving performance objectives; Identify lessons learned so that they can be applied to subsequent activities or tasks; Increase confidence in performance capability; and Increase proficiency of all participants. These learnings are compiled, edited, and stored in a structured knowledge base for further studies and to be available in future situations.
- **Outcome Feedback** – of how work products perform in the external or internal customer environment – is necessary information on which to base work performance assessments. Unfortunately, it frequently is not regularly available. Consequently, organizations and individuals have limited insights into how they may improve their performance, improve products and services, or otherwise innovate. Outcome feedback is provided in several ways. One approach is a formalized system for internal and external customers to evaluate received products or services. Use of questionnaires in merchandizing and many service industries is typical but not considered very effective. Other, more effective approaches include on-site studies of how work products are utilized by recipients and how well they satisfy real requirements.⁸
- **Expert Networks** – are used to provide formalized capabilities for workers in the field to consult or collaborate with topic experts on complex or unfamiliar tasks. Several mechanisms and infrastructure elements may be used to create and support an expert network. They include: (a) Guides to “who knows what” in the form of “yellow page” systems on intranets, knowledge inventories, or knowledge roadmaps; (b) Policies that permit knowledge worker access to experts; (c) Budgets for experts to help knowledge workers; (d) Communication channels that range from on-site expert visits, face-to-face meetings, telephone consultations, e-mail, groupware-based communication, video

⁷ For description of AAR, see for example <<http://www.luminella.com/aar.htm>> (May 22, 2000) and <<http://www-dcst.monroe.army.mil/wfxxi/op-anx-f.htm>> (May 22, 2000).

⁸ For complex work products highly effective outcome feedback includes studies of potentials for: (a) Innovation to improve product performance in customer environment; (b) Including additional features in the products and services such as embedded or companion knowledge and expertise; (c) Different products and services; and (d) Education of users in how better to use and leverage products and services.

conferencing, and so on; (e) Learnings capture systems to build frequently asked questions (FAQ) help systems; and (f) Outcome feedback analysis and capture systems.

- **Knowledge Discovery from Data (KDD)** – uses sophisticated statistical or automatic reasoning methods to identify patterns of interesting cause-effect relationships. An example is the discovery of intervention methods that had proven effective for treatment of mental disorders in large populations (USA and the Netherlands).
- **Performance Support Systems (PSS) and Knowledge-Based System (KBS) Applications** – A computer-based system which contains explicit or implicit domain knowledge used specifically for reasoning about specific situations. Examples of KBSs are case-based reasoning (CBR) systems, expert systems, and neural nets. Recently, as a result of the systematic perspectives encouraged by explicit KM, the reliance of automated knowledge and reasoning has changed within many organizations. Instead of being considered as stand-alone or relatively isolated solutions to relieve particular critical knowledge-related functions, knowledge-based systems (KBSs) are now often considered as integral building blocks within a larger knowledge management (KM) perspective.
- **Build and Deploy Knowledge Bases** – A knowledge base (KB) is a component of a knowledge-based system which contains the system's domain knowledge in some representation suitable for the system to reason with. Knowledge in knowledge bases is typically represented in a standard format. KBs are important repositories for explicit knowledge. They can contain “knowledge” in the form of unstructured natural language documents, or in many other representations. For structured KBs, editing (“rational reconstruction”) of the acquired knowledge is needed. KBs are also equipped with retrieval mechanisms that can range from simple query languages to sophisticated intelligent agents.
- **Information Technology Tools for Knowledge Management** – A large number of IT tools are available for KM support. These tools are under constant development and new capabilities are introduced repeatedly.

A class of IT-based will operate on and support categorization and linking of natural language documents. Most of these tools will also create intranet portals. Many have limited natural language (concept) understanding and indexing capabilities. The Internet URLs for some tools in use are:

- ✓ Semio Corporation <<http://www.semio.com>> and <<http://demo.semio.com>>
- ✓ Verity Corporation <<http://www.verity.com>>
- ✓ Excalibur Technologies Corporation <<http://www.excaliburtechnologies.com>>
- ✓ GrapeVINE Technologies Corporation <<http://www.grapevine.com/>>
- ✓ Plumtree Software Corporation <<http://www.plumtree.com>>
- ✓ Sequoia Software Corporation <<http://www.sequoiasoftware.com>>
- ✓ Autonomy Corporation <<http://www.autonomy.com>>
- ✓ Northern Light Corporation <<http://www.NorthernLight.com>> and <<http://nlresearch.northernlight.com/research.html>>

Another class of tools support computer-based reasoning systems. Some vendors and service providers are (name of company followed by name of tool and URL where available):

- ✓ AcknoSoft - KATE-CBR <<http://www.acknosoft.com/>>
- ✓ Astea International - Case-1 <<http://www.astea.com/>>
- ✓ Atlantis - SpotLight <<http://www.cs.bris.ac.uk/~dattani/research.html>>
- ✓ Brightware, Inc. - ART*-Enterprise <<http://www.brightware.com/~knightly>> & <<http://www.brightware.com/~knightly/aesum.html>>
- ✓ CECASE - Mem-1
- ✓ Cognitive Systems, Inc. - ReMind
- ✓ Continuum Software Inc. - work on projective visualization <<http://www.continuumsi.com>>
- ✓ Esteem Software, Inc. - ESTEEM <<http://www.shai.com/esteem.html>>
- ✓ The Haley Enterprise - Eclipse (includes The Easy Reasoner) <<http://www.haley.com/ter.html>>
- ✓ iDetect Software - MINDSuite <<http://www.idetect-software.com>>
- ✓ Intelligent Applications Ltd - CBR Service Providers <<http://www.intapp.co.uk>>
- ✓ Interactive Multimedia Systems - Analyzing/building/maintaining case bases consultants <<http://www.imsgrp.com/imm/>>
- ✓ Inductive Solutions, Inc. - CasePower (formally Induce-It) <<http://www.wsdinc.com/products/p1145.shtml>>
- ✓ Inference Corporation - CBR Content Navigator (family of products) including CasePoint WebServer <<http://www.inference.com>> & <<http://m5.inference.com/products/>> & <<http://m5.inference.com/wcp/>> & <<http://www.broderbund.com/>>
- ✓ Intelligent Applications Limited - Markets CSI's ReMind in Europe <<http://www.cityscape.co.uk/ia/>>
- ✓ ISoft - ReCall and ALICE d'ISoft <<http://www.alice-soft.com>>
- ✓ Lockheed - Recon (not marketed) <<http://www.aic.nrl.navy.mil/~aha/research/http://hitchhiker.space.lockheed.com/~recon/>>
- ✓ ServiceSoft - Knowledge Builder & Web Advisor & Product Demos <<http://www.servicesoft.com/>> & <<http://www.servicesoft.com/products/knowledgebuilder.html>>
- ✓ Simon Fraser University - Case Advisor Webserver & Case Advisor 2.1 <<http://www.cs.sfu.ca/cbr>> & <<http://www.cs.sfu.ca/cbr/webserver.html>>
- ✓ Software Artistry - Expert Advisor
- ✓ SHAI: Stottler-Henke Associates, Inc. - ESTEEM <<http://www.shai.com/>>
- ✓ TecInno GmbH - CBR-Works (formally S3-Case) <<http://www.tecinno.de/english/index.html>>
- ✓ TreeTools - Helpdesk-3 <<http://www.treetools.com.br/>>

In addition to these tools, other IT tools support e-mail, limited groupware, and other communications capabilities.

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