Application of Knowledge Management in Public Administration

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Contents

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Knowledge Management (KM) plays important roles in Public Administration (PA). 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: Enhance decision making within public services; Aid the public to participate effectively in public decision making; Build competitive societal IC capabilities; and Develop knowledge-competitive work force. Numerous KM approaches are adopted to serve these purposes. Most efforts address specific needs. Only few pursue broad, deliberate, and systematic KM. Examples of these approaches and perspectives are discussed. The premise for KM is that among many factors, effective and intelligent behavior depends on having appropriate understanding in addition to being informed.

Introduction

Viability and success of any society is largely a function of how its resources can be leveraged. They include natural resources, geographic location, capability of people, and resources like intellectual capital (IC).[1] Public Administration (PA) in any society is important and complex. It affects most aspects of society. Its approach and effectiveness determine the society's culture, quality of life, success, and viability. It also acts as pace setter, planner, implementer, educator, peacemaker, and disciplinarian, all with different emphases depending on the society's culture and agendas. A competent PA 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 cooperate in many ways and have confidence in the society's capabilities, directions, and actions. Successful citizen participation and confidence depend largely on broad understanding of, and agreement with actions by public entities and acceptance of 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 possesses, is made available to its public servants, and is embedded in structural and other intellectual capital assets that can be leveraged internally and in the global market.

PA shares responsibility to assure that its society provides the quality of life intended for its citizens. From a societal knowledge or IC perspective, this implies participation in building and leveraging 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 regional and global economies. These issues are well known to public administrators (PAs). 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,

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[1] Intellectual capital (IC) is used to denote all aspects of personal tacit and explicit knowledge as well as structural intellectual capital, be it explicit, embedded in technology, or in other forms.

capabilities, and practices to assist PA to great advantage. It becomes a new responsibility to manage knowledge to strengthen public service effectiveness and improve the society it serves.

KM goals are to improve the effectiveness and sustained viability of any 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. The KM objectives for PA in a democracy may be expressed as the intent to provide:

➢ Effective PA services and functions to implement the public agenda. Public services must address issues and requirements relevantly, competently, and timely and consume minimal resources. They should also deal appropriately and expeditiously with unexpected challenges and disasters.

➢ A stable, just, orderly, and secure society. This includes preparing 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 support for the administration.

➢ Acceptable level of quality of life, particularly through building, maintaining, and leveraging commercial and public intellectual capital.

➢ A prosperous society by developing its citizens to become competent knowledge workers and its institutions to be competitive.

Comprehensive Knowledge Management

Recently, the roles of knowledge and understanding for organizational performance have become clearer. Early on, managerial emphasis was placed on observable work. Later it included the role of information. Now, focus 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 considerations of broader work processes or knowledge mechanisms within organizations.[2] There has been little focus on invisible work, particularly on how workers think and utilize knowledge when performing tasks.

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 and Duguid, 2000; Damasio, 1994 and 1999; Halpern, 1989; Nonaka and Takeuchi, 1995; Klein, 1998; Schön, 1983; Wiig, 1993). Gradually, leaders start to focus on managing knowledge deliberately and systematically. KM has emerged to create and leverage IC into the business equation and into public management (Allee, 1998; Böhme and Stehr, 1986; OECD, 2000; Reich, 1991; Wiig, 1994 and 1997). IT is used extensively to support KM although many information management tools are marketed as being "Knowledge Management" tools, which they arguably are not. Knowledge, it must be realized, is distinctly different from information and that KM and information management are not the same.

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[2] Systematic approaches, when applied to societal processes, emphasize applying systems theory to deal with interconnectedness, effects over time, parallelisms, and nonlinear behaviors.

Figure 1 provides a perspective – a dynamic model – of the role that IC assets play in enterprise performance. Four principal factors are indicated: Enablers; Drivers; Facilitators; and Mechanisms. Solid arrows indicate performance-influencing relationships. Broken arrows indicate dominant relationships between factors. Knowledge and other ICs 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. Mechanisms consist of the functional elements that are manipulated – the processes that operate to produce actions. 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.

Knowledge has often been managed implicitly and without specific focus. Deliberate and systematic KM – comprehensive KM – 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:
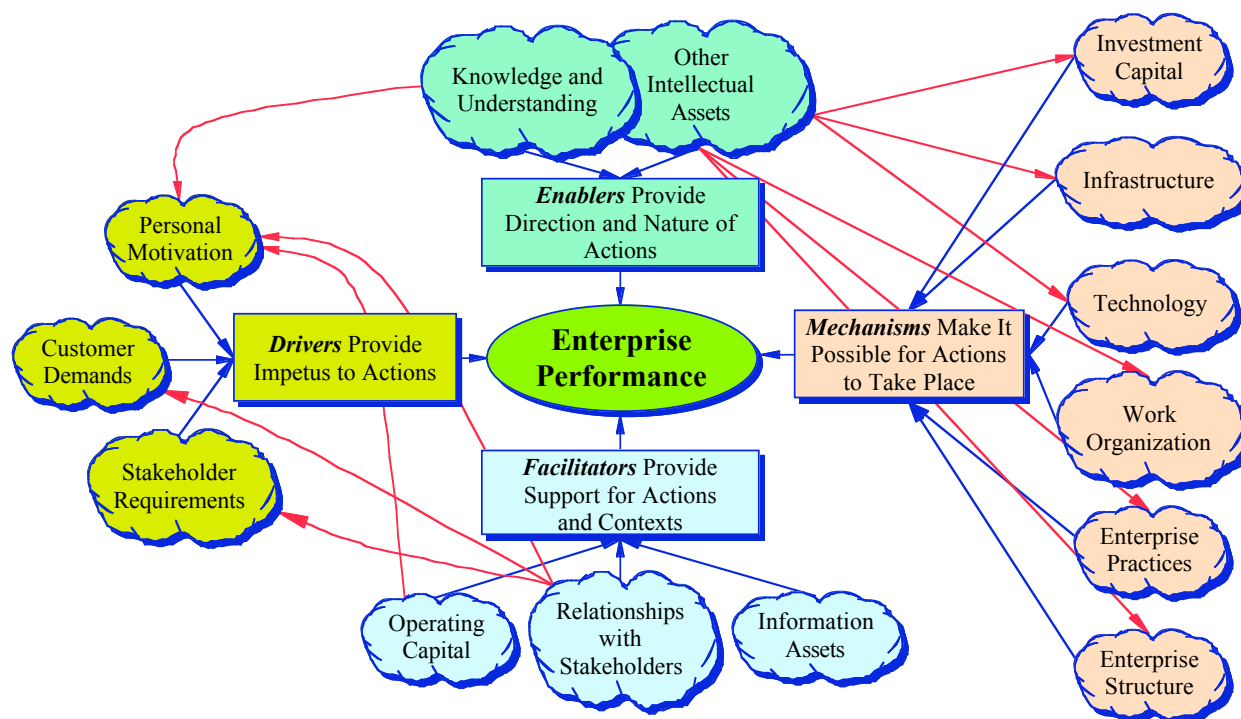
Figure 1. A Perspective of the Role of Knowledge in Enterprise Performance.

1. Identify which 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 IC assets 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, in contrast, tends to arbitrarily identify and pursue a knowledge-related action as extensions of occurring activities – incremental improvements on 'business-as-usual' without focus on ascertaining that the knowledge assets are applied.

Enterprises that pursue comprehensive KM pursue sub-practices that in combination contribute to the overall success. They focus vigilantly on making knowledge work effectively as chief enabler of enterprise performance. These sub-practices include efforts to:

➢ Focus the KM vision and practice to align with enterprise direction.

➢ Provide effective governance for the KM practice.

➢ Promote integrative management culture 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 individual's own interest.

➢ Practice accelerated learning – by pursuing a broad range of knowledge transfer activities to ascertain that valuable IC is captured, organized and structured, deployed widely, and used and leveraged. The impetus is on making important IC 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 – by placing employees in situations where they can use their capabilities.

➢ Give permission – by providing employees with safe environments in which to do their work and have understanding of how far they can improvise enterprise guidelines and policies to serve individual situations and customers.

➢ Foster motivation – by motivating employees to act intelligently – 'to do the right thing' – and providing understanding and emotional acceptance of how actions will be of value to stakeholders, the enterprise, and most importantly, to themselves.

➢ Create supportive infrastructure capabilities – by including extensive IT applications.

Comprehensive KM can be pursued with any of many potential activities. Figure 2 provides examples of a few such activities with indications of how they fall into four main functional areas:

➢ 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.

Comprehensive KM recognizes that enterprise strategy is decided in the boardroom or by legislatures by deliberate 'decisions-in-the-large.' However, strategy implementation frequently is achieved through the minute 'decisions-in-the-small' that public servants and other people make as part of their daily work. Strategy and business direction is most often implemented in the field and on the factory floor and depends on comprehensive KM to build shared understanding of enterprise direction and intents.

When pursuing comprehensive KM, a constant requirement is to identify the expected benefits and work to achieve them. This is particularly important since "managing knowledge" itself in reality is impossible – only knowledge-related actions and processes can be managed.
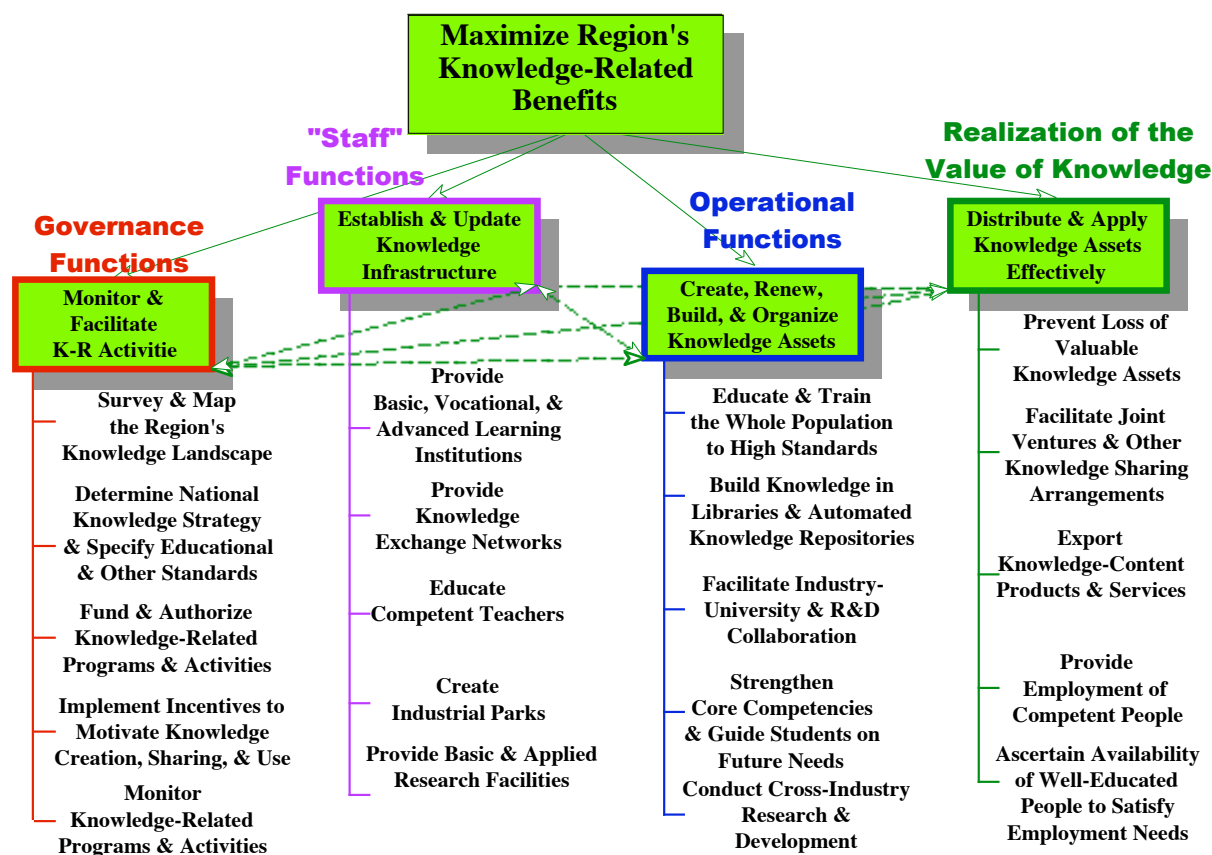

Figure 2. Examples of Knowledge Management Activities in Four Functional Areas.

Public Administrators' Role in Societal Knowledge Management

PA functions in the modern, democratic society are complex. Ideally, but unrealistically, civil servants should possess the best expertise and collaborate with experts with the most advanced state-of-the-art understanding. While at times being experts, they should also be lead facilitators and KM moderators. However, communication difficulties in societal KM may make it difficult to walk the narrow line between: (a) having deep and special insights into how to proceed and (b) involving the public and special needs groups in a collaborating process. PAs must provide initiatives, leadership, and coordination to implement the most effective approaches and to ascertain that society as a whole is served appropriately.

The role of guiding and governing society's agendas for public IC falls to PAs. The conceptual leadership for KM must in part reside with PA but must also be shared with all stakeholders. Broad KM practice must ultimately be the responsibility of each public agency and each civil servant. Without broad agreement on concepts KM will not be effective. A separate, but small PA entity or office should be created to support the KM practice. Its function must be supportive, innovative, and collaborative. It must avoid being prescriptive and 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 society goals and objectives. It must also communicate with legislatures and public agencies to secure resources required to pursue the knowledge agenda. It must collaborate with citizen groups and the business community to facilitate joint programs, determine capabilities, opportunities, needs, and constraints (CONC) analysis.[3] The office must maintain the broad vision for comprehensive KM and facilitate its adoption across all society's entities. It must secure shared resources that individual agencies cannot justify and provide methodological leadership with ensure common standards to allow interoperability, uniform access, collaboration, and knowledge sharing. These demands lead to needs for specialized expertise in several areas and the KM office staff should have considerable expertise in areas like public policy. In addition they should have – or have access to – KM expertise such as Knowledge Engineering, Management Sciences, Cognitive Sciences, Social Sciences, Library Sciences, Philology or Linguistics, Artificial Intelligence, and Advanced Computer Sciences.

PA entities have broad responsibilities in pursuit of societal objectives. PA governs and facilitates public aspects of operations and life of public and private organizations and individual citizens. When considering knowledge-related issues, such responsibilities cover not only knowledge-related functions within PA. Responsibilities extends to govern and facilitate other knowledge-related and affected areas, particularly preparing effective policy partners, building and leveraging societal IC, and building and maintaining a capable and competitive workforce. Figure 3 indicates examples of KM actions in the four areas. Furthermore, the responsibility also includes creating and governing the overall vision, perspective, and strategy for the society's general KM practice.

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[3] Capabilities, Opportunities, Needs, and Constraints (CONC) analysis is similar to Threats, Opportunities, Weaknesses, Strengths (TOWS) analysis but includes knowledge that provides a perspectives difference.

Intelligent Enterprise Behavior

Primary Factors

Proper Knowledge

Extensive Information

Culture & Incentives

Personal Motivation

Systems, Policies & Permissions

Time & Other Resources

Supportive Infrastructure

Conduct Desired Work
Deliver Work Products
Secure & Improve Contexts
Conserve & Preserve Resources
Renew Enterprise Capabilities

Research & Development Programs

Learning Organization

Focus on Core Competencies

Total Quality Management

Intellectual Capital Building

Education & Other Knowledge Deployment

Application of Best Knowledge

Knowledge Acquisition & Packaging

Organization Architecture

Business Process Redesign

Active Knowledge Management

Resulting Effects

• Better Products
• Better Services
• Greater Internal Effectiveness
• Lower Costs
• Better Employee Relations

• Increased Value to Customers
• Increased Value to Stakeholders
• Greater Value to Society
• Greater Attainment of Objectives
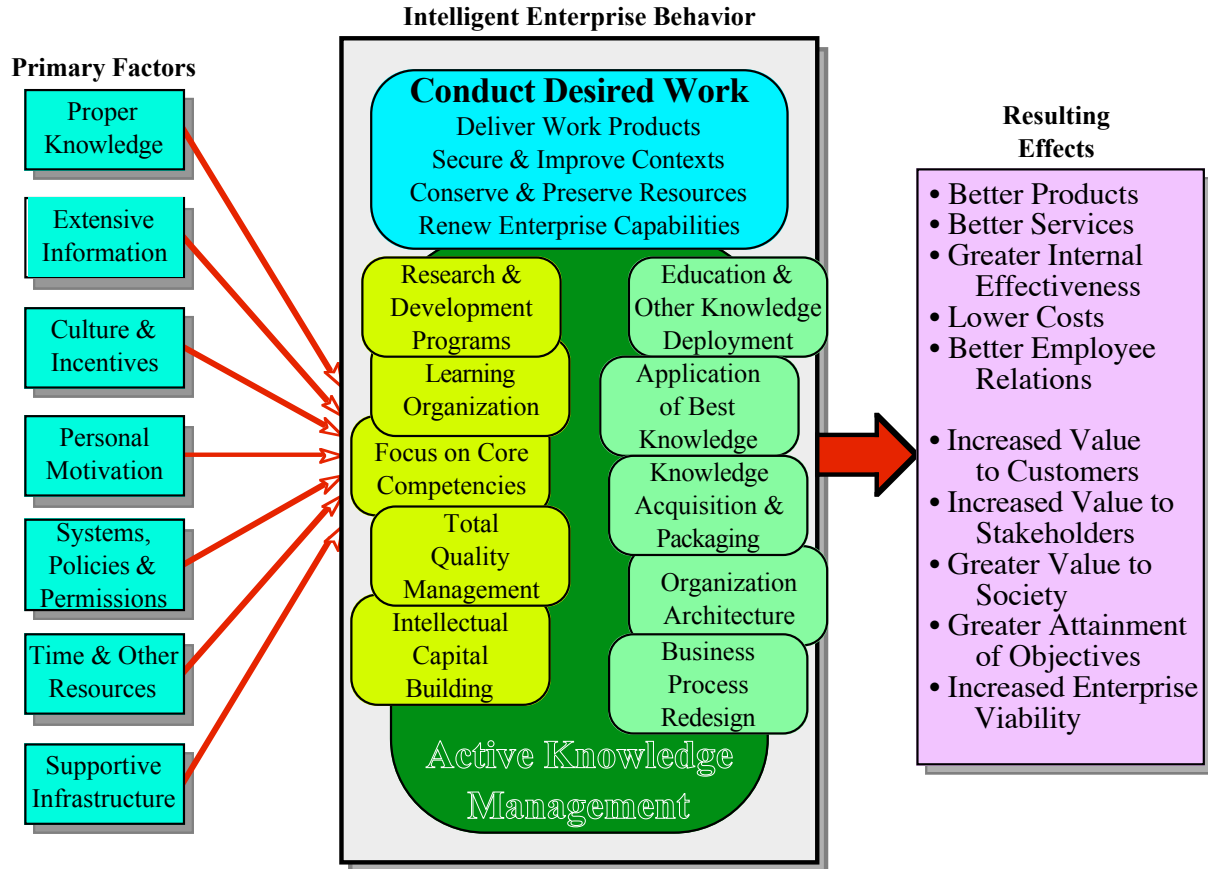• Increased Enterprise Viability

Figure 3. Primary Factors Needed to Deliver Desired Work .

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 expected 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 potential governing steps to start a broad KM practice include:

➢ 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 PA 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 IC-related policies and obtain legislative commitments and fundings for the overall program.
> ➢ Govern the overall IC – related practice.

Assure Competent and Effective Public Service

- Area KM Practice Vision
- CONC Map
- Plan Rollout
- Share Understandings
- Accelerate Learning
- Create LL System

Conduct Comprehensive Public Administration Knowledge Management

- Vision for KM Practice
- Knowledge Landscape Map w. Capabilities, Opportunities, Needs, & Constraints
- Knowledge-Related Policies
- Resources & Commitments
- Govern KM Practice

Build and Leverage Public and Private IC

- Area KM Practice Vision
- CONC Map
- Regional Objectives
- Legal & Policy Changes
- Public Contracts
- Public R&D Agencies
- Technology Parks

Prepare Effective Policy Partners

- Area KM Practice Vision
- CONC Map
- Public Education Pgms
- Public Dialog Pgms
- Networks of Interest

Develop Capable Knowledge Workers

- Area KM Practice Vision
- CONC Map
- Regional Goals
- Educational Programs
- Teaching Institutions
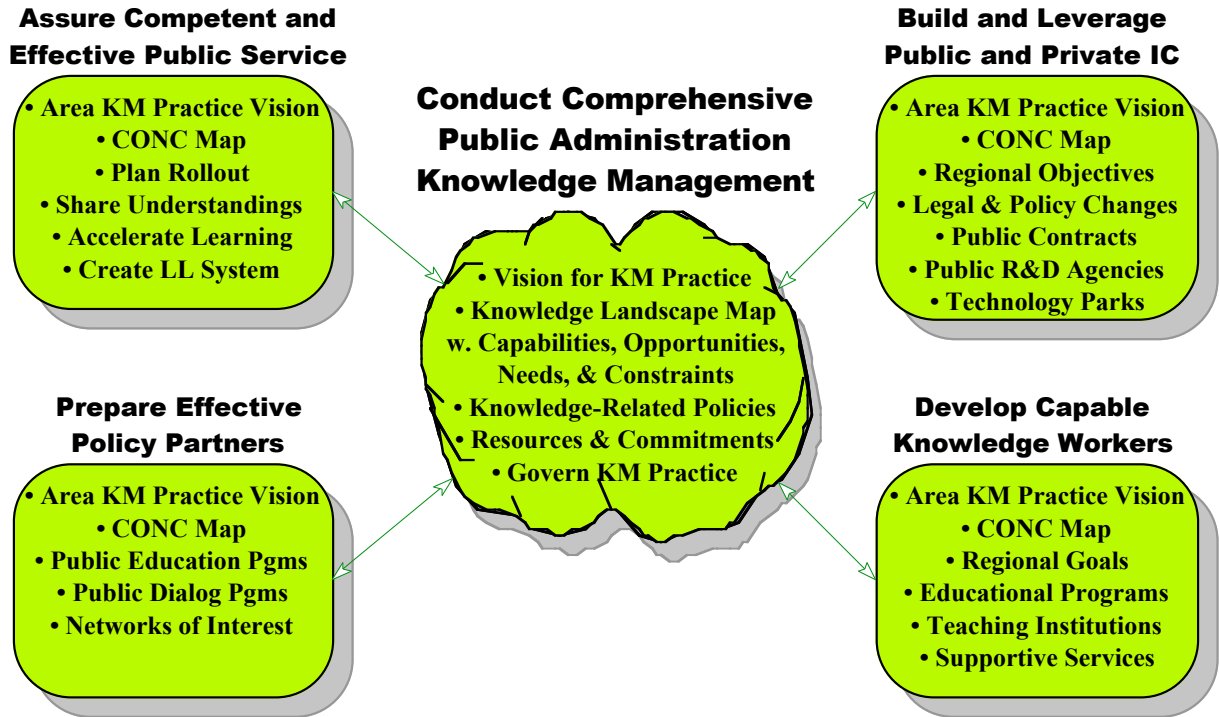- Supportive Services

Figure 4. Elements of Public Administration Knowledge Management Practice.

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 KM activities, 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 4 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 KM practice within PA 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 adaptable plan to provide desired versatility. This often requires creating infrastructure elements that will serve most desired purposes but may require replacement within the overall planning horizon.

Assure Competent and Effective Public Services

The success and viability of any society depend upon how well its public services are provided. Quality and effectiveness of PA services are influenced by many factors. Organizational structures, responsibilities, capacities, information, civil servant personal expertise, and otherwise available IC are factors that affect the performance desired from the enterprise. Among these, IC assets are primary enablers as indicated in Figure 1. They are the basic resources that govern nature and directions of actions. Without adequate ICs, even when given the best information, actions will be based on ignorance – lack of understanding – and will be arbitrary and ineffective. Consequently, it is of importance to manage knowledge to make public services act knowledgeably. However, IC alone is not sufficient. Other primary factors are indicated in Figure 5 with examples of the active KM activities they support to deliver the desired resulting effects.

Assure Competent and Effective Public Service

Round 2
• b2b Capabilities
• Advanced PPS

Round 1
• Intranets
• Knowledge Bases
• Lessons Learned Systems
• Groupware

Build and Leverage Public and Private IC

Round 2
• Advanced Technology
• Intelligent Agents

Round 1
• Communication infrastructure
• Knowledge repositories
• General access mechansims

Joint IT-Related Infrastructure

• Communication Infrastructure
• Knowledge Repository Architectures
• 'Net Technology Capabilities
• PSS Development Capabilities
• Advanced KM-related IT Capabilities
• Knowledge Professional Capabilities
• Knowledge Deployment Capabilities

Prepare Effective Policy Partners

Round 2
• e-Based Education
• 'Net access for all

Round 1
• Public Info Systems
• IT-Based Education
• Agency web-sites
• Hyperlinked documents

Develop Capable Knowledge Workers

Round 2
• e-Based Education
• PCs for all

Round 1
• 'Net access everywhere
• 'Net navigation education
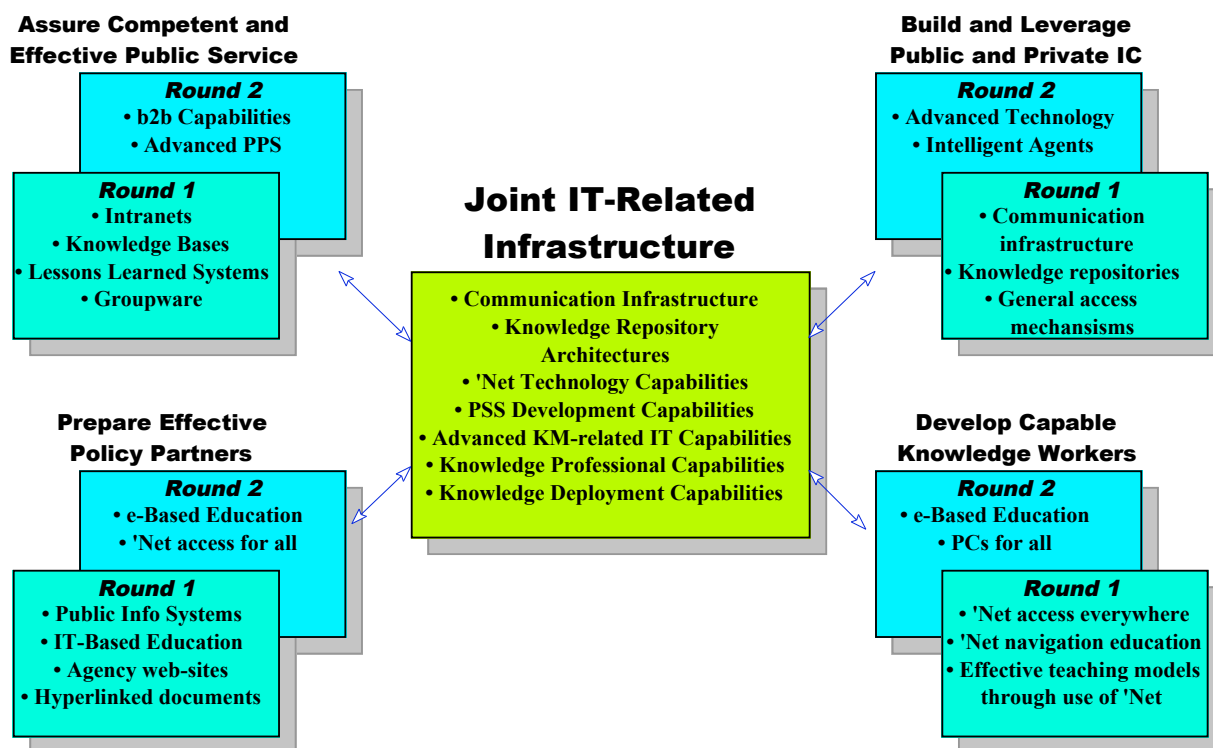• Effective teaching models through use of 'Net

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

Creating and maintaining competent public services is not simple. As for other organizations, and was indicated in Figure 3, the overall effectiveness of public agencies depends on individual effectiveness based on intelligent behavior by its people, their motivation, and 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, the enabling factor is IC. That includes the expertise and understanding that individuals can command to perform immediate work. It also includes knowledge embedded in policies, procedures, organization of work, work aids, and infrastructure. Comprehensive KM provides approaches to improve and leverage 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 to themselves. In general, KM approaches developed for private organizations are highly relevant for public service organizations.

Managing knowledge to provide effective PA 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 room for improvement. Modern comprehensive KM build upon established practices by adding capabilities and approaches.

Different KM approaches may be implemented to support effective performance. Which options to implement and when, become functions of expectations for performance changes, available resources, support of the overall KM practice, broader enterprise needs, and other factors. A number of KM approaches are open to PAs to manage knowledge or to create comprehensive KM practices.

Prepare Effective Policy Partners

PAs help the public understand needs and direction of public activities, programs, and projects. They inform the public about planned or proposed actions through hearings, town meetings, and informative news programs. Unfortunately, these may be marginally effective. Often, they do not provide in-depth dialog to correct wrongful understandings that many citizens have of proposed actions. Citizens are faced with being engaged in "informed decision making" while having limited understanding of implications. They are not prepared to participate as knowledgeable decision makers on their own behalf. Much resistance against public actions has resulted from public ignorance or misunderstanding. Also, inappropriate public actions may be approved by a public that does not understand its negative sides. Effective and efficient transfer of deep knowledge and understanding can improve the public's insight by use of KM methods.

Public governance is more effective when citizens have understanding of directions, options, issues, and opportunities. It is particularly value if value systems and 'models of the world' are shared with PAs.[4] That, however, does not mean that everyone should agree! No society can expect all its citizens to build deep and shared insights. 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 have the desired results, communications must be knowledge-effective and preferably closed loop with feedbacks through dialog (Wiig 1995, 327-334).

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[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.

In dealings with the public, many problems are caused by the wide difference in mental models and resulting understandings that exist in the general population. The public's insights often are different from those of PAs. PAs may have developed extensive knowledge of proposed actions, although at times from narrower perspectives than those available in the public-at-large which will be aware of circumstances not known to PA. The administration's views are not always right. In a democracy, special interests may pursue undesirable public actions which rightfully should be modified extensively or defeated by the citizenry as better understandings are developed.

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 PAs to assist the public to become more effective policy partners, the following should be indicated.

Build and Leverage Public and Private Intellectual Capital

A country's viable success depends upon its leveragable resources. Public and private IC of all kinds create significant opportunities for success and PA influences both creation and leveraging of IC. Also, in today's global economy technology is important. Hence, public support to creation technology and research parks and knowledge flow clusters is important for building environments where world class expertise can congregate and provide environments of synergy. In addition, knowledge-related actions often are complemented with other actions to facilitate the desired results. For example, tax or import-export restrictions may have to be eased to attract external industry that can benefit from a well educated domestic work force.

On a national level, PA influences knowledge-related mechanisms for building and leveraging IC assets in many ways. These include patent policies and legal support for value realization and protection enforcement of IC. Other 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 to create and leverage public and private IC. Societies benefit from knowledge-related activities in several ways. Some result in increased trade and economic activity. In particular, developments of IC assets such as world-competitive expertise and knowledge-based products can result in valuable economic and trade changes.

Larger economic activity leads to increased employment, trade, and area payroll with associated positive economic impacts. However, as for other societal developments, many of these impacts take time to realize. Numerous mechanisms are available to PAs to create IC assets directly or to facilitate their creation in the private sector. In the private sector, public KM need to be governed by the desired national or regional strategy. IC asset development must be related to available resources and current conditions. Governments frequently allocate resources to create capabilities to obtain specific results. While providing the desired primary results, such actions often also develop highly valuable secondary IC assets and capabilities.

Develop Capable Knowledge Workers

Societies depend upon the capability of their work forces. An uneducated or unmotivated work force obliges the society to rely on natural resources to be successful, and even that is questionable. In today's global economy where 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, PA needs to play an active role also in this area. To be effective, its role must be based on clear and flexible visions of what should be achieved, which societal results should obtain, and how it should be done.

Developing a competent work force requires decades. Several perspectives should be kept in mind when considering how to envision and manage the work force development:

➢ **Transverse Perspective** consider work force requirements and developments across industries and societal functions. They cover developing citizens with competitive expertise – in all disciplines and industries required. These perspectives consider the breadth of areas such as: Agriculture and fisheries; Tangible goods industries; Service industries; Educational functions; Research institutions; Civil services; and Defense functions.

➢ **Longitudinal Perspectives** start with infants throughout childhood, schooling, and preparation of trade workers and professionals. These perspectives consider all 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.

➢ **Political Process and Resource Allocation Perspectives** consider society's objectives, public opinions, interest group influences, and the time, communication, and other realities of political processes. Also considered are societal priorities, funding capabilities, and availabilities of public and private resources.

➢ **Methodological Perspectives** consider knowledge-related practices, methods, and activities that can be undertaken to achieve the desired goals.

PA 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 results obtain. PAs must provide initiatives, leadership, and coordination to bring about the most effective approaches and ascertain that society as a whole is served appropriately.

Knowledge Management Activities and Benefits

KM can be approached in numerous ways to serve particular needs and conditions. Successful KM practices typically need to be supported by complementary efforts in different domains. It therefore is helpful to consider the activities needed for governance and infrastructure in addition to the operational activities that normally are center of attention. Examples of activities in the three domains are presented in Tables 1, 2, and 3.

Effective KM is expected to provide many benefits. Some are short-term and most often influence performance directly. Others have longer term effects and may develop capabilities that allow new strategies or different ways of operating. Table 4 provides a few examples of benefits that can be expected.

Concluding Comments

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

In the modern society, applications of KM practices supported by KM methods, including IT-based tools, have become important to pursue societal goals with success. PAs in most nations and regions have started to implement approaches to achieve well-defined objectives and this trend is 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, yet it is important to start small and target clear goals.

Societies consist of entities whose behaviors are determined by personal knowledge or ICs embedded in systems, procedures, technologies, and computer-based systems, to name a few. Knowledge-related entities include knowledge producers (sources), knowledge holders, knowledge transfer agents, knowledge and information distributors, and knowledge consumers. Pathways connect these entities through knowledge flows such as those illustrated in Figure 6. The "societal knowledge system" operates as a living organism with multiple goals, resources, information exchanges, flows of many kinds, and self regulating mechanisms. Unfortunately, some, such as the market mechanisms may too often be inefficient. The knowledge system changes and adapts to economic and social demands and it therefore is important to maintain the vision and overview for overall system and how it might operate in the modern, competitive society.

In particular, the need for comprehensive KM within and in support of PA is important. KM plays a central role to make PA function more effectively. More importantly, comprehensive KM governed by PAs 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 and thereby increase the quality of life for its citizens.
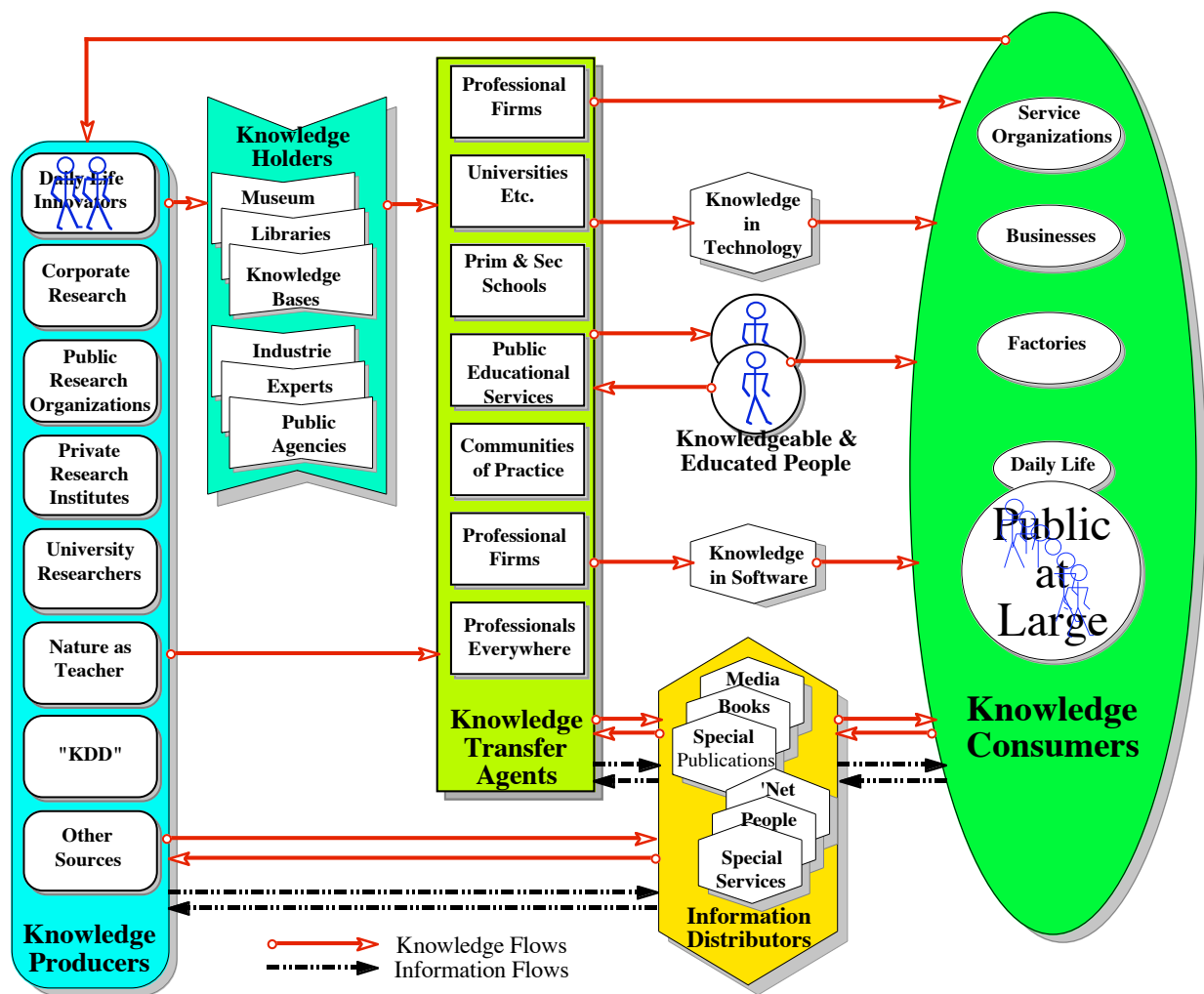
Figure 6. Examples of Societal Knowledge Entities and Related Flows.

Table 1. Examples of Governance Activities

Activity Focal Point	Assure Competent and Effective Public Services	Prepare Public to Become Effective Policy Partners	Build and Leverage Public and Private IC	Develop Capable Knowledge Workers
Create a vision for what KM will do for the region's PA	Focus on benefits and impacts that might be expected from the KM practice	Focus on how KM can assist making the public effective policy partners	Focus on building and leveraging public intellectual capital – approaches, results	Focus on long-term work force development program
Survey and map current state of knowledge with associated CONC analysis	Focus on critical agencies and functional priority areas	Focus on functions of priority that the general public must engage in	Focus on societal knowledge sources, transfer agents and consumers	Focus on relevant age levels and existing and future areas of specialization
Make strategy, tactics, and short-term plans for building and leveraging IC	Create plans for strengthening public services by developing new knowledge flows	Prepare plans for widespread and effective interactive public communications	Develop plans that address present and future public objectives for viable competitiveness	Develop public policy to build knowledgeable work force for all expected industrial and business areas
Provide KM-related incentives, guidelines and policies	Reflect desirable KM practices in employee evaluations	Provide guidelines and funding for public dialog	Implement trade and business policies and agreements	Develop educational guidelines and standards
Create "Integrative Management Cultures"	Change work practices and culture drivers within agencies	Build broad public knowledge awareness and vigilance	Promote IC building and leveraging mentalities	Infuse understanding of the value of competence and how to achieve it
Identify and implement knowledge-related steps	Initiate educational and other steps based on contingency and disaster plans	Develop collaborative relations with media and other communications channels	Foster industry/ government/educational collaborations in support of IC programs	Collaborate with business and industry to address future needs with targeted programs
Provide legislative and financial supports	Require quality public services	Support public dialog and communication	Obtain grants and tax incentives supports	Fund public education programs and facilities
Monitor and govern	Maximize effectiveness of KM practices in PA	Obtain public policy partnering to oversee processes	Govern IC building processes from public interest perspective	Coordinate public and private educational efforts

Table 2. Examples of Infrastructure Activities

Assure Competent and Effective Public Services	Prepare Public to Become Effective Policy Partners	Build and Leverage Public and Private IC	Develop Capable Knowledge Workers
Build extensive IT infrastructure to support effective KM such as collaboration, automated reasoning, knowledge discovery, etc.	Create web-sites for public actions to provide information and in-depth descriptions of proposed and ongoing actions	Build tailored technical infrastructure capabilities including specialized architectures for knowledge bases and other repositories, knowledge acquisition systems, intelligent access to knowledge and information	Provide IT infrastructures for schools, colleges, and universities and integrate it with Internet, scientific institutions, and relevant business and industry
Build communities of practice within agencies and networks of practice between agencies and with the public to strengthen collaboration, knowledge sharing, learning, and innovation	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 public R&D facilities – defense laboratories, fishery institutes, agricultural research stations	Educate and re-educate teachers and educational administrators to implement the public education contents and paradigms
Build PA educational capabilities	Build capabilities to create effective education and information materials	Build public educational institutions – universities, trade schools	Develop and operate e-based public education for targeted and Life-Long Learning
Build an office for Knowledge Administration and Create KM professional core staff	Create publicly accessible and well organized information repositories and libraries	Build industry-specific and specialized libraries and knowledge repositories	Build needed educational capacities – new and expanded institutions
Develop and apply knowledge sharing practices	Provide citizens who do not have computers with public facilities for all to have access to public intranets	Build technology innovation parks and educational institutions and programs	Provide students at all levels with personal computers or equivalents

Table 3. Examples of Operational Activities

Assure Competent and Effective Public Services	Prepare Public to Become Effective Policy Partners	Build and Leverage Public and Private IC	Develop Capable Knowledge Workers
Educate public servants in functional topic knowledge and metaknowledge such as critical thinking and enterprise navigational knowledge	Provide deep communications of proposed actions to explain principles and expected implications to the public	Award contracts and conduct public R&D to learning organizations, private institutions, and public laboratories	Develop and deploy educational materials such as books, advanced technology-based materials
Capture innovations, lessons learned, and other knowledge, transform the captured knowledge into suitable formats, and deploy it	Utilize all media channels to provide frequent and reliable communications about public activities and related effects that concern the community	Facilitate transfer of emerging knowledge to proprietary and competitive IC through R&D, patent procedures and regulatory processes	Develop curricula, tests and proficiency requirements, text book content requirements, and models (role models) for effective teaching
Transfer expertise from exceptional performers to other knowledge workers and transfer tacit knowledge into structural knowledge	Facilitate networks of common interest throughout the community for the purpose of building joint understanding as well as to be able to conduct dialogs	Undertake publicly supported benchmarking programs within the local society and world-wide to ascertain that "best knowledge" is available and is used	Develop mechanisms to communicate expectations for future employment needs to the public
Form collaborative liaisons with private entities and public agencies in preparation for dealing with problems like earthquakes, typhoons, floods, draughts, epidemics, social unrests, and terrorism	Maintain publicly accessible data bases on all non-restricted PA aspects Equip systems with search facilities and automatic reasoning such as natural language understanding	Promote creation and operation of professional societies and other knowledge-creating, exchanging and refining bodies and networks	Educate the public in theoretical and practical topic knowledge for daily life and craft and professional functions, metaknowledge, critical thinking, and broad navigational knowledge
Motivate and reward public servants for sharing knowledge and for using others' ideas and expertise to improve their work	Distribute learning materials to provide understanding of public issues ranging from health and environmental issues to communications about potential future work force needs – to make possible public decision participation	Publish or facilitate private publishing of scientific and trade journals and technical and scientific reports using conventional and high-technology channels	Develop and deploy educational and behavioral role models for classroom teachers, students, and the home

Table 4. Examples of Potential Knowledge Management Benefits

Assure Competent and Effective Public Services	Prepare Public to Become Effective Policy Partners	Build and Leverage Public and Private IC	Develop Capable Knowledge Workers
Competent and secure public servants with broad understandings leads to: Proposing and pursuing public projects that fulfill national and regional strategies and support public interests	Knowledgeable people who participate in public decision making leads to: Setting societal priorities that reflect the public opinion and a society with greater public acceptability	Well developed and organized public and private IC will lead to: Pursuing priority initiatives that improve performance and competitiveness	Competent and capable work force will lead to: Ability for nation or region to pursue strategies that depend upon competitive knowledge industries
Competent and effective public service will lead to: Quicker public actions and lower costs of public services	Engaging citizens and interest groups in creative collaboration for potential and new public actions will lead to: Public support and active influence in shaping society-wide actions	Regional IC that provides successful products and services will lead to: Improved exports: It also will make the emerging work force seek areas of potential professional success will lead	Nationally competent people will lead to: All "doing the right thing first time" resulting in lower costs and improved performance
Extensive collaboration within and between agencies, members of the public, industrial and business partners, and special interest groups will lead to: Effective public actions that address real societal needs	A public that is an effective policy partner will lead to: Less friction and public unrest, less cost of maintaining order and operating the judicial system	• Commerce expertise will lead to: Increased trading with existing and new partners • Scientific expertise in areas such as agriculture will lead to: Increased food production and export of agricultural products	• Providing educated and skilled people in suitable numbers leads to: Satisfying employment requirements for greater competitiveness • Providing a competent population leads to: Low unemployment and improved quality of life
"Always use best knowledge" mentality supported by incentives, guidelines and policies, and reflected in employee evaluations and placing public servants in positions where they can use their expertise will lead to: Consistently high quality and reliable public decisions and actions	A public that is an effective policy partner will lead to: Greater efficiency of public service and greater satisfaction among public servants with greater personnel retention and knowledge-building	• Financial expertise leads to: Local enterprises proper world players; External institutions are attracted to fund and form regional financial centers • Medical expertise leads to: Attracting outsiders to conduct business within the region and to healthy and able work force	Industries operated with world-class expertise will lead to: Regional ripple effects that spread capabilities and increase innovation and effectiveness and reduce operating costs with resulting increases in global competitiveness

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 Integrative Management Culture
> 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

o **Create Integrative Management Culture–or "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 smarter and 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.

o **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

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[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.

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.

o **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>

o **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.

o **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

o **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.

o **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 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..

o **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.

o **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.

o **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

o **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 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).

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[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.

o **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.

o **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]

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

o **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).

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[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.

o **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.

o **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.

o **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 tools will operate on and support categorization and linking of natural language documents. Most of these tools will also assist in creating 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. Northern Light> 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/ttp://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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