

Knowledge Manageability: A New Paradigm

Albert J. Simard and Philippe Jourdeuil

Defence Research and Development Canada
Information and Knowledge Management Directorate

Abstract

Although the knowledge society is evolving rapidly, uptake of knowledge management principles and practices in the public sector has lagged well behind that in the private sector. To help overcome this difficulty, the knowledge management mantra that industrial-era cultures must change in order for KM to succeed is reformulated into a new paradigm: Within an existing culture, how can knowledge management increase the value of organizational knowledge and the productivity of knowledge work? The paradigm uses the Cynefin sense-making framework as a foundation for knowledge manageability. Four knowledge manageability regimes are described: authoritative hierarchy (use of explicit knowledge is authorized through organizational decisions), organizational structure (explicit knowledge is codified and interpreted to structure and coordinate organizational processes), negotiated agreements (tacit knowledge is exchanged among individuals and within communities to validate new knowledge), and responsible autonomy (innate knowledge is voluntarily used by individuals to create new knowledge). Most organizations use all four regimes, each of which requires a different approach to management. The chapter also describes methods for transferring knowledge from one regime to another. The knowledge manageability framework encompasses a spectrum from dynamic, unstructured organizational environments to relatively inflexible, highly structured environments. It provides a robust, multi-dimensional framework for managing knowledge and knowledge work across diverse organizational contexts. By avoiding the need to change inherently structured culture and work processes, it greatly reduces the challenges associated with implementing knowledge management in public-sector organizations.

Keywords: knowledge management, knowledge flow, Cynefin framework, strategy, authority, structure, agreement, autonomy

1. Introduction

In the 21st century knowledge society, organizations must manage their knowledge as a core resource and knowledge work as the critical production factor or risk irrelevance (public sector) or eventual failure (private sector) as others outperform them, their key employees leave without sharing what they know, or even worse, they share it with competitors. A number of authors have commented on the magnitude of the changes that lie ahead. One of the earliest was Drucker (1993) who stated: “The new challenge facing the post-capitalist society is the productivity of knowledge workers and service workers. To improve the productivity of knowledge workers will in fact require drastic changes in the structure of the organizations of post-capitalist society, and in the structure of society itself” (p83).

Rubenson and Schuetze (2000) describe a sweeping socioeconomic vision: “The knowledge-based economy and society challenges the foundations of the social contract that provided the glue for industrial societies after the Second World War. The foundations of the new social contract are not yet clear, but many see the likelihood of a new consensus, based on current realities, that enhances economic prosperity and social cohesion” (xiii). Similarly, Allee (2003) observes: “We are currently engaged in a global learning journey that is so massive it is altering the perspectives, goals, and behaviors of entire societies. We are forging new relationships, new strategies, identities, purposes, language, and new organizational forms” (p. 16).

Florida (2002) explains that the transformation will challenge existing organizational structures: “Perhaps the biggest issue at stake in this emerging age is the ongoing tension between creativity and organization. The creative process is social, not just individual, and thus forms of organization are necessary. But elements of organization can and frequently do stifle creativity” (p. 22). This provides a perfect segue to the underlying purpose of this chapter – how can highly structured departments and agencies in the public sector manage inherently unstructured knowledge and knowledge work.

Although the knowledge society is evolving rapidly, uptake of knowledge management principles and practices in the public sector has lagged well behind the private sector. Many reasons could be cited for this discrepancy. We begin by setting aside a number of arguments that cannot fully account for the observed differences. A substantial KM literature, available to all organizations, implies that lack of understanding of knowledge management in the public sector only accounts for part of this gap. Resistance to change, a hallmark of all bureaucratic institutions, also only accounts for a part of the gap as evidenced by many short-term or partial successes that have occurred¹. Given that most government agencies have technological capacity equal to that in the private sector excludes capacity as a primary barrier. Finally, there is a rapid turnover of senior managers in the public sector, although this should not adversely affect an organization that is culturally ready for change. Although all these considerations affect the implementation of KM programs in the public sector, there are methods of minimizing them. We must look elsewhere to discover the root causes of the difficulty of implementing knowledge management in the public sector.

¹ For example, see: <http://www.slideshare.net/Al.Simard/knowledge-management-putting-the-puzzle-together-one-piece-at-a-time>

Knowledge management has evolved through three generations (Dixon, 2010). The first generation emphasized explicit knowledge contained in documents. The focus was on knowledge structures and technology that was difficult to distinguish from information management. The second generation involved sharing tacit knowledge among individuals. The emphasis shifted to interactions and relationships among individuals and communities – a significant departure from managing knowledge objects. The third generation involved collaboration, peer production, and synergy through social networks. The domain was now concerned with complex social processes such as voluntarism, self-organization, and emergent knowledge.

Knowledge management has been increasingly distancing itself from industrial-era command and control approaches to management and moving towards the ephemeral end of the management spectrum. The evolution of knowledge management reflects a significant shift from highly structured, easy-to-measure transactional processes to unstructured hard-to-measure relationships, such as engagement and emergence. This transformation has been away from activities that reflect the underlying nature of work in the public sector, towards activities that are difficult for the public sector to implement given their institutional role in society.

For example, the public sector employs highly-structured, totally accessible processes for interacting with citizens. It legislates and enforces specific laws prescribing socially acceptable behavior that require compliance. Public-sector activities must be demonstrably equitable for all parties, often in a context of competing interests. Policy decisions are public and their rationale is available for all to see. Success is mandatory in the public sector; experimentation and learning through failure are not options. The public sector is not mandated to manage ephemeral relationships such as trust and respect among individuals.

The mantra that industrial-era approaches to management must change in order for knowledge management to succeed poses many difficulties given the nature of the information and knowledge work done by the public sector. Further, command, control, and compliance approaches to management have existed since the dawn of civilization because they are the most appropriate approach for addressing some needs of society, such as national defence, the law, and regulation. Finally, standards, structure, and rules are prerequisites to many socioeconomic functions such as business, commerce, and markets, interoperability among systems and networks, and equity and fairness among individuals and groups.

What if the knowledge management mantra were reversed. What if the KM goal was rephrased? **Given an existing culture, how can knowledge management increase the value of organizational knowledge and the productivity of knowledge work?** This chapter proposes a different approach to knowledge management by examining knowledge through the lens of its manageability in an organizational context rather than according to its underlying nature or form, such as explicit or tacit. It focuses on the relational and psychological perspectives that drive individual behavior, group dynamics, and organizational culture. We describe specific management activities that can be undertaken by an organization to increase the value and utility of its knowledge and support its discovery and sharing to achieve organizational goals.

A framework of four management regimes (authoritative hierarchy, organizational structure, negotiated agreement, and responsible autonomy) is used to describe how knowledge can be

managed by organizations to support accomplishing business goals. The regimes are not mutually exclusive but rather overlap somewhat and blend into one another. This framework provides a structure for knowledge management both within an organization and across organizational and jurisdictional boundaries because it focuses on the underlying *raison d'être* for the management regime, the types of interactions it manages, the dimension of knowledge managed and how that knowledge is expressed. This is not proposed as a “theory of knowledge management,” but rather as a practical approach to managing the different dimensions of knowledge and knowledge work within an organization.

As knowledge flows from creation to application, it is transferred between people across functional boundaries and manageability regimes. These transfers do not simply happen naturally; like pumping water uphill, they must be made to happen. Organizations must implement processes to actively transfer different types of knowledge (innate, tacit, explicit, and authoritative) across functions (creation, validation, structuring, and authorization) and manageability regimes (responsible autonomy, negotiated agreement, organizational structure, and authoritative hierarchy). The chapter concludes by describing methods for enabling knowledge flow from creation to application.

This chapter refers to a “new” paradigm, not a paradigm “shift.” In the physical sciences, there is only one paradigm at a time except during a shift from old to new (Kuhn, 1970). In the “hard” sciences, a new paradigm is proven to be superior to an existing one by explaining more of what is observed in nature without negating anything that was known previously. Once accepted, those who do not work within the context of the new paradigm are gradually shunted from the mainstream of scientific enquiry. In contrast, the social sciences operate under multiple parallel paradigms because none can be proven to be superior to any other. Each analyst interprets the available paradigms in the context of their problem and uses the one that seems to provide the best explanation. We believe that KM practitioners will see “knowledge manageability” as an improvement over existing approaches to addressing many knowledge management problems that does not negate any previous knowledge.

2. Knowledge Management

Knowledge spans all domains of human activity and the debate between the perspectives, insights, and beliefs related to it affects the multitude of interactions among them. From a human perspective, it ranges from cognition, through individual interaction with the environment, to how we choose to interpret what we perceive. It also shapes human behavior and group dynamics. From an organizational point of view, knowledge spans all divisions of labor, occupational and production structures, as well as processes, technology, products, and services. Knowledge resides in both knowledge objects and in the minds of people. It is imperfectly transferred between people, with various degrees of latency and effort, through knowledge objects, systems, and relationships.

Knowledge is essential to running an organization, creating value in the form of products and services, interacting with partners and stakeholders, and serving clients. As Savage (1990) points out: “The shift from the industrial to knowledge eras is primarily one of attitudes, values and norms. It can only come through a struggle of thought, because most of the changes are

counterintuitive. We are so conditioned by the vocabulary of the industrial era that it is often difficult to think in new terms” (p. 76). That knowledge has organizational value is borne out by the efforts of nations and businesses to conduct open and covert intelligence operations to acquire knowledge from others. It is typically more cost-effective to acquire what others know rather than to conduct the research needed to create that knowledge directly. The value added is through the insights of others, blind alleys not followed, and mistakes not made in acquiring knowledge from others rather than creating knowledge directly. Clearly, managing what an organization already knows provides organizational value that exceeds the cost and effort of creating it.

2.1 Defining Knowledge

Knowledge – the fundamental resource of the knowledge economy – is inherently context sensitive. This partially explains why there are as many, if not more, definitions of knowledge as there are practitioners in the field. Two-and-a-half millennia of debate among philosophers have not resolved the fundamental nature of knowledge. Language exacerbates the problem. English has only one word for knowledge, which often makes it difficult to distinguish from information. French recognizes two types of knowledge – *connaissance* (awareness) and *savoir* (understanding). Aristotle recognized three: *episteme* (abstract, theoretical), *techne* (technical expertise), and *phronesis* (individual experience). Resorting to a dictionary provides little help, as one typically finds ten or more definitions, often circular (what is known) or in terms of data or information, which are other forms of content rather than knowledge.

The long-standing philosophical definition of knowledge – justified true belief – conceals more than it reveals about knowledge. Although very broad and well-founded, each term in the definition is subjective and must be interpreted and defined across a range of contexts. Further, this definition does not admit the skills of a master craftsman or artist embodied through years of practice. It also does not admit innate intuition, creativity, or imagination, nor does it admit “unjustified” opinion, bias or misconception. In essence, the philosophical definition primarily provides a framework for structuring philosophical debate.

We start with a more rigorous “science-based” definition of knowledge: ***Understanding or capacity arising from conscious or unconscious reasoning about data, information, or experience to reveal cause-and-effect relationships that facilitate the explanation and prediction of physical, natural, or social phenomena.*** This definition not only admits scientific knowledge, but also individual experience (mental models), organizational knowledge (culture), and skill acquired through practice. It is useful for distinguishing between knowledge (understanding that enables prediction) and information (meaning in context). This is important from a knowledge creation perspective, because information is a final output that cannot be decomposed to create new information, whereas knowledge can be reused to create new knowledge in an endless cycle.

Although rigorous, the scientific definition is not sufficiently broad from an organizational perspective. Pigeau (2004) argues that although organizations are structures of individuals and resources for achieving common objectives, the bulk of it resides in people, their interrelations, their memories, and their behavior. Organizational charts are rarely sufficient to describe the real structure of an organization because they represent only the espoused structure, not necessarily

the practiced structure. An organizational structure essentially resides in the knowledge people have of the organization and its objectives. However its objectives are social constructs because people, not objects, have objectives, goals, aims, and purposes. Consequently, sharing information and knowledge is a social-psychological activity that needs explicit direction (e.g., vision & mission) and requires socialization to interpret and live that interpretation.

Pigeau's psychological definition of knowledge holds that **“knowledge is that which a person accepts as true and encodes in memory for future use”** is more useful from an organizational perspective. He posits that before someone accepts something as true and encodes it in memory, they process it through a set of five truth-acceptance criteria (perception, authority, consensus, coherence-in and coherence-out) and notes that their weights vary in different situations. This situational weighing explains why people find it hard to let go of deeply held beliefs even in the face of overwhelming evidence, yet can be fairly flexible in other areas. It is important to understand that the psychological definition of knowledge is not based on philosophical justification or actual truth, but rather on acceptance as truth.

Pigeau also argues that because knowledge is filtered through the truth acceptance criteria of each person it touches and is subject to different interpretations, it is difficult to synchronize individual beliefs and the resulting organizational activity. The organizational problem is one of bringing together individuals and small groups and harnessing their insights and creativity to achieve strategic goals that may not be evident at an operational level. To do so, organizations must engage individuals and develop work processes and systems that facilitate personal interactions in an environment of trust. It must then capture and structure innovative or emergent knowledge so that it can be incorporated into new products and services.

The truth-acceptance criteria help explain a number of observations about knowledge.

- Some knowledge is accepted with ease and some is very resistant to acceptance, depending on the degree of personal investment the individual had in originally acquiring the knowledge being displaced.
- Culture, or organizational knowledge is very hard to change, as it requires a similar degree of truth acceptance by a large number of people.
- Successful organizations are those that make it easy for their members to align their personal and team objectives with those of the organization. Organizations are most likely to succeed if those affected by change are involved in their creation.
- Effort is required to convert explicit knowledge contained in knowledge artefacts into tacit knowledge in individuals and groups. The larger the group in which you want to instil tacit knowledge, the greater the effort required.
- Some knowledge remains tacit despite efforts to make it explicit through socialization, regularization, and simplification while some is easy to make explicit and use to reproduce routine action.

In a psychological context, knowledge management is about:

- reducing the cognitive dissonance between evidence presented to the five truth acceptance criteria of each member of an organization;
- reducing the emotional stake that individuals or teams have about knowledge and the resulting activity;
- facilitating the alignment of personal, group, and organizational goals;
- engaging employees to create new knowledge and pursue opportunities for innovation;
- encouraging participation in internal and external communities to discover and validate knowledge through dialogue; and
- supporting interaction among people and groups across the organization to discuss and socialize objectives and change, and for management to perceive areas of misalignment.

The psychological definition of knowledge is useful for describing what becomes knowledge in people and how it happens. This definition makes knowledge a personal thing that includes intuition, creativity, and imagination as well as deep craft. Further, it helps to explain why it takes such effort to change culture or deeply held beliefs. A psychological view is applicable to our quest for a practical approach to managing knowledge in an organization and it helps to explain why the social dimension is so important to this process.

This approach has implications for knowledge management. First, knowledge management implies organizational actions aimed at influencing what people in one or more groups accept as true. Second, organizations and societies need to expend large amounts of energy reducing cognitive dissonance to develop socially accepted knowledge structures while, at the same time, maintaining diversity and its associated multiple perspectives. They do this by developing structures that make information and resources easy to access and find, simplify processes and rules to facilitate interactions between people and processes, and facilitate creating and maintaining communities. In essence, fostering common understanding of a situation or a concept involves implementing mechanisms and processes that help to resolve the cognitive dissonance between the truth acceptance criteria of individuals in an organization. This involves much more than just articulating policy or directives, establishing rules, developing transaction-based processes, reducing degrees of freedom, and measuring performance.

We conclude this discussion of knowledge with a comprehensive set of principles developed by Snowden²:

- Knowledge can only be volunteered, it cannot be conscripted.
- We only know what we know when we need to know it.
- In the context of real need, few people withhold their knowledge.
- Everything is fragmented.
- Tolerated failure imprints learning better than success.
- The way we know things is not the way we report we know things.
- We know more than we can say, and we say more than we can write.

² http://www.cognitive-edge.com/blogs/dave/2008/10/rendering_knowledge.php

In each of these principles we see dimensions of knowledge that everyone is familiar with and yet pose challenges to management's traditional comfort zone. The degree to which we can manage different types of knowledge depends on the degree to which we can structure, measure, and manage people and systems. The degree to which knowledge is not manageable depends on the extent to which it lies in those dimensions that tend toward intangible and ephemeral states.

Snowden states that while tacit knowledge was useful in the past it is becoming problematic and there is a pressing need to recognize the importance of both narrative and concrete knowledge. The living nature of human knowing requires learning communities that can act as critical infrastructure for the transfer of concrete knowledge through storytelling, imitation, and mentoring. Equally important, is the realization that people and what they know also define and are defined by their narratives.

2.2 Evolution of Knowledge Management

The evolution of knowledge management provides insights into knowledge manageability. In just two decades, knowledge management has evolved through three generations – from assets through sharing, to collaboration (Anklam, 2007; Dixon, 2010). The first generation focused on creating, acquiring, and preserving explicit knowledge. In fact, elements of managing explicit knowledge objects date back to the Library of Alexandria – 2,500 years ago. We can generally manage explicit knowledge in a structured way – much like data and information. Although there are variations in processes, methods, and particularly outcomes of use, all forms of explicit knowledge must be captured, organized, preserved, and made accessible. Differences arise in the methods used to execute these functions.

As knowledge management invented itself, a few themes emerged. Leonard (1995) stated: “To manage knowledge assets, we need not merely to identify them but to understand them – in depth – in all their complexity: where they exist, how they grow or atrophy, how manager's actions affect their visibility” (p. xii). Stewart (1997) observed: “The purpose of knowledge management systems - be they corporate universities, staff experts, or knowledge databases - isn't to heap up knowledge for its own sake, but for the sake of knowledge workers” (p. 139). Nonaka (1998) stated: “In an economy where the only certainty is uncertainty, the one sure source of lasting competitive advantage is knowledge” (p. 22). Drucker (1999) concluded: “The most important... contribution of management in the 20th Century was the fifty-fold increase in the productivity of the manual worker in manufacturing. The most important contribution management needs to make in the 21st Century is a similar increase in the productivity of knowledge work and the knowledge worker” (p. 135).

The second generation emphasized sharing, integrating, and using tacit knowledge. This is clearly different from managing data and information, as it involves discovering expertise and supporting social interaction. We can promote and support the exchange of tacit knowledge, for example with a directory of expertise or communities of practice, but we cannot manage it in the same structured sense as explicit knowledge assets. It is important to understand, however, that as tacit knowledge is captured and made explicit, systems and processes must be in place to structure and manage it, or it will be lost. For those aspects of tacit knowledge that cannot be made explicit, we must manage social and relational opportunities to transfer such knowledge

and pass it on from person to person or from individual to group through collaboration or communities.

O'Dell and Grayson (1998) observed that sharing is about people, not technology: "Knowledge management does not rely on technology to make processes more efficient. It relies on recognizing the knowledge resident in people's minds, using technology to facilitate its sharing, not replace its human origins" (p. 10). Horibe (1999) noted that incentives are essential to sharing: "Because sharing is always voluntary, the challenge is to create an environment in which people both want to share what they know and make use of what others know (p. 11). Saint-Onge and Armstrong (2004) portrayed sharing from a learning perspective: "An organization's intangible assets are made of capabilities and relationships that are built through the exchange of knowledge... Knowledge exchange serves as the bases for accelerating learning and systematically developing individual and organizational capabilities" (p38). Buckman described a competitive view: "In a knowledge-driven marketplace, knowledge sharing – the pooling of tacit knowledge and understanding from mind to mind across a whole organization – is what separates the leaders from the also-rans" (p31).

A third generation of knowledge management is evolving – using conversations, collaboration, and synergy within communities and networks to create, share, and make emergent knowledge accessible. Social interactions can be formal or informal and are largely based on culture. They may be semi-permanent or form and dissolve on an 'as-needed' basis. They encourage and facilitate the creation and use of emergent knowledge. The search for a scientific "home run" or "viral" growth in a network happens more often in learning organizations that create a diverse environment that is more likely to capture emerging trends and changes. Organizations that don't support conversation, collaboration, and communities have difficulty capturing and leveraging the emergent knowledge generated in this chaotic knowledge space. Management must focus on architectures of participation, cultural conventions, and organizational incentives that encourage this to happen.

Elroy (2003) notes: "Communities or groups...engage in a process of knowledge making and evaluation. Each member brings his or her "knowledge claims" to the table, and together they are scrutinized, discussed, modified, and refined. New knowledge is shaped in this way, and out of this process comes community-made knowledge claims of a highly refined and tested form" (p. 96). Allee (2003) states: "The traditional view regards each enterprise as a lone competitor, scrambling for a niche in its business ecosystem. Now we are beginning to regard every enterprise as a node in complex interdependent value networks, where success comes through collaboration, cooperation, and creating a business environment where everybody can be successful, including competitors" (p. 71). Tapscott and Williams (2006) observe: "The new promise of collaboration is that with peer production we will harness human skill, ingenuity, and intelligence more efficiently and effectively than anything we have witnessed previously" (p.18).

2.3 Current Frameworks

In its early days, knowledge management focused on capturing and managing explicit knowledge because of its amenability to structure and control – the contemporary management paradigm. Recent work on KM has shifted towards the intangible which has, in turn, shifted focus to managing conditions, context, and environments that facilitate knowledge generation,

exchange, and collaboration. This is necessary because knowledge that resides in people's heads, within teams and communities, and throughout an organization's culture can only be rented or leased by an organization if it is transferred to others or made explicit in some way. The most effective method of transferring tacit knowledge is through face-to-face interaction, conversation, and dialogue, whether supported and facilitated by technology or not.

Some traditional human resource practices facilitate knowledge transfer between individuals. Retention policies are aimed at keeping people and their knowledge in the organization. Succession planning and mentoring are aimed at facilitating the transfer of tacit knowledge and experience via direct interactions between people. They also provide opportunities to do new things in a safe-fail environment through mentorships, acting assignments, and other development opportunities. Succession planning and mentoring provide conditions under which people are fully engaged and the use of their knowledge is fully leveraged. In fact, communities with their semi-structured mentorships provide excellent opportunities for building common understanding. This reinforces the importance of the roles of the community leader, champion, and facilitator in ensuring that a community remains aligned with organizational values, objectives, and culture. Although the authors have proposed a strong linkage between HR and KM,³ this chapter focuses specifically on KM.

There are many frameworks that could be applied to KM. We outline seven that are relevant here: business operations, IT engagement, bureaucratic/entrepreneurial, organizational views, cognition/learning, knowledge creation, and sense-making.

2.3.1 Business Operations

Ross et. al. (2006) propose a business framework that uses four operating models as its core. They emphasize that the role of technology is to simplify the capture and improve the trust and availability of the routine and essential knowledge of the organization. Their four quadrants are characterized in terms of low or high integration and standardization. This allows the organization to focus on interactions designed to harvest the nuggets in the patterns, trends and opportunities they are faced with. The success of social computing applications shows that people are seeking to find better and cheaper ways to converse.

They developed a four-quadrant framework of business operating models.

- Replication (independent but similar business units sharing best practices – *high standardization, low integration*)
- Unification (single business unit with global process standards and data access – *high standardization, high integration*);
- Coordination (business units that need to know each other's transactions – *low standardization, high integration*); and
- Diversification (independent business units with different clients and expertise – *low standardization, low integration*).

³ See: <http://www.slideshare.net/albertsimard/human-resources-and-social-networks-the-future-has-arrived12>

The choice of operating models is the fundamental underpinning of decisions relating to the design and implementation of an IT infrastructure. It also affects the degree to which an organization chooses to embed its knowledge and ways of working into its business model.

Most large organizations use most, if not all, of the four business models for different aspects of their work. For example, routine business processes, such as purchasing, travel, and project management would generally use a replication model for consistency. Global processes, such as information technology, security, and management would tend to emphasize unification and standards for interoperability. Projects involving multiple groups or locations would focus on coordination and interaction, whereas scientific research and social networking would be based on diversification of knowledge, expertise, and activity.

2.3.2 Information Technology Engagement

Weill and Ross (2009) developed a framework for engaging business managers in IT governance. The purpose of this framework is to explicitly recognize the need for negotiated agreements between business and IT leadership, at the enterprise, business unit, and project level. The agreements specify the appropriate balance and priorities for investing in, designing, developing, and implementing an organizational IT infrastructure. This is the realm of negotiations between business units over what is important and deserves investment and what effort should be devoted to transforming tacit knowledge and ways of working into explicit ones. The role of this framework is to focus IT governance on the right decisions.

The Intel Business Value Index described by Carty and Lansford (2009) categorizes the impact of IT investments on both IT efficiency and business value as negative, neutral, or positive. The index focuses IT investment on those things that enhance business value and improve IT efficiency (*positive/positive*) or at least enhance one function without degrading the other (*positive/neutral*). It also aims to avoid those investments that benefit no one, or that provide no tangible benefit to business or IT efficiency and have a negative impact on the other function (*negative/negative or negative/neutral*). Finally, it identifies the impact of making dichotomous decisions (*positive/negative*) or those that lie in between (*neutral/neutral*). The guidelines help to decide what IT investments to make, avoid, or tread lightly.

2.3.3 Bureaucratic / Entrepreneurial

Conner (1998) developed a framework of 14 attributes to distinguish between bureaucratic and entrepreneurial organizations (Table 1). He identified the end-points of a continuum for each attribute. He observed that as the rate of change in organizational environments increased, organizations would have to shift from bureaucratic (structured) forms of management to more entrepreneurial (nimble) forms to succeed and, ultimately, to survive. He also acknowledged that at various times, and for various functions the most appropriate position on each continuum will move back and forth. He recommended a number of techniques for shifting from structured to nimble approaches to management. This framework emphasizes the difference between industrial-era and knowledge-era approaches to management. It represents an early approach to describing the multiple facets of an organization, in that classifying attributes is the first step towards detecting patterns and understanding.

Table 1. Bureaucratic – Entrepreneurial Continua (adapted from Conner, 1998)

Attribute	Bureaucratic Organization	Entrepreneurial Organization
Work	individual	team
Flexibility	discipline	improvise
Structure	rigid	fuzzy
Ideas	shared	diverse
Change	exploit what works	continuous improvement
Reasoning	logic	intuition
Tolerance	zero defects	learn from mistakes
Horizon	near-term results	long-term vision
Interaction	tactful feedback	frank dialogue
Pressure	urgency	patience
Success	pride in accomplishment	humility for what’s not done
Accountability	accomplish tasks regardless	forgive human shortcomings
Approach	manage segments	lead the whole
Conflict	minimize disagreement	appreciate unorthodoxy

2.3.4 Organizational Views

Morgan (1986) used six metaphors to describe the many facets of an organization as an entity. Each metaphor implies a way of perceiving the world, a way of reasoning, a preferred approach to decision making and taking action. Each perspective has both strengths and weaknesses. Most organizations combine aspects of several metaphors in varying proportions.

- *Machine*: Each interlocking part plays a clearly defined role in the efficient functioning of the whole. This industrial-era, mechanical way of viewing organizations is so engrained that it is difficult to view organizations in any other way.
- *Organism*: The focus is on organizational needs and its relations with its environment. Different “species” of organizations (e.g., command, bureaucracy, partnership, entrepreneurial) vary in their birth, development, growth, decline, and adaptability to their environment. This can be likened to the current concept of knowledge ecosystems.
- *Brain*: Information processing, learning and intelligence are highly valued. Self-organization is highlighted when a high degree of flexibility and innovation are needed. This approach clearly relates to social networking and knowledge organizations.
- *Culture*: Values, norms, rituals, and beliefs that sustain organizations as social entities are emphasized. Organizational designs are based on patterns of shared meaning that guide organizational life. All organizations have a culture that affects everything they do.
- *Political entity*: Different interests, conflicts, and power plays shape organizational activity. This view is based on political principles and legitimizing rules that govern organizational life. This view emphasizes the need to interact with and negotiate among multiple, sometimes competing, organizational functions.
- *Learning entities*: Fluctuation and transformation provide insights for understanding and managing organizational change and the forces that shape the social nature of an organization. This clearly presages the concept of learning organizations.

All of these processes tend to occur naturally in social structures. The structure and processes of a knowledge organization would enhance, facilitate, and support its organic, brain, cultural, and learning aspects while recognizing but downplaying, reducing, and discouraging, its mechanical and political aspects.

2.3.5 Cognition / Learning

Senge (2006) proposes a framework that emphasizes a systems approach to management and cognitive disciplines related to learning. He argues that industrial-age concepts of knowledge and management condition us to believe that knowledge is power, and lead us to hoard our stock, and be reluctant to share. This contributes to underlying assumptions that shape our actions and color our visible information exchanges and processes. He concludes that the crux of organizational success is related to being able to harmonize personal and organizational agendas, identify biases, and create an organizational climate that supports conversations between people in teams.

Success involves using a systems approach to management, in which all aspects of a problem or issue are considered as a whole. Management actions must address underlying root causes instead of focusing on visible symptoms which, when addressed, seem to solve apparent problems temporarily but often exacerbate the root problem. Senge argues that success can only be achieved through five main disciplines (personal mastery, shared vision, mental models, dialogue, and systems thinking). These are essential for developing three core learning capabilities of teams (fostering aspiration, developing reflective conversations, and understanding complexity).

2.3.6 Knowledge Creation

Nonaka and Takeuchi (1995) provide a knowledge creation framework that focuses on the cyclic flow of knowledge from tacit to explicit and back again. This widely-used model represents a humanistic approach to knowledge management. It comprises a four-quadrant cycle emphasizing the transformation of one type of knowledge into another. It also describes the process through which knowledge is transferred from one quadrant to the next. Their model can be modified to show that it also applies to interactions between individuals and groups as they deal with tacit and explicit knowledge. Their four quadrants are:

- A new idea in the mind of an individual is transferred to a group through externalization and documentation (*tacit-explicit*).
- The documented idea is integrated with others through combination and structuring (*explicit-explicit*).
- The structured idea is accepted by an individual through internalization and memorization (*explicit-tacit*).
- The memorized idea is used by an individual to create a new idea (*tacit-tacit*).

The Nonaka-Takeuchi model emerged in and is well-suited to the context of an eastern philosophy that what is known is inseparable from the knower; that the individual is inseparably interdependent and embedded with the world and society. Hence, the inherent value of sharing tacit knowledge and the value of collaboration are generally understood and accepted; they need no measurement, business case, or cost-benefit analysis to be endorsed and approved. Pigeau

(2004) also posits that psychologically, what is known is inseparable from the knower, as it is based on what the individual accepts as true and encodes in memory for future action. This also helps to explain why what is known by one may be difficult to transfer to another through the filter of their truth acceptance criteria. Management must help to resolve the cognitive dissonance that occurs when conflicting inputs collide while maintaining diverse perspectives and avoiding “groupthink.”

This view is very different from the western Cartesian philosophy that separates what is known from the knower or that separates observation from the observer. The separation between subject and object has been an underpinning of western science for four centuries and management practice in the last century. It has also led to an emphasis on measurability and reward (primarily extrinsic) of individual accomplishment. Although the distinction between observation and observer is breaking down at the leading edge of both science and management, it remains well-entrenched in western culture, particularly in bureaucracies. The value of sharing tacit knowledge and collaboration within a team or organization must be demonstrated to workers that are compensated based on what they know and do and to a management culture that demands measurement. This presents a formidable barrier to establishing knowledge management programs for less tangible forms of knowledge.

2.3.7 Sense Making

Kurtz and Snowden (2003), developed the Cynefin sense-making / categorization framework comprising five domains: ordered-known, ordered-knowable, unordered-complex, unordered-chaos, and disorder (Figure 1). In sense-making, the framework emerges from data or attributes of situations whereas in classification, the framework is predetermined and situations are classified within it (Snowden, 2007). Although it is more powerful when used for sense-making, classification is both simpler and sufficient for our purposes. As he explains, although reality is a continuum, humans are “not good with gradients.” Classification helps to categorize the underlying nature of things which, in turn, determines the most appropriate approaches to analysis, decision making, and management.

Their known (common, routine)⁴ and knowable (complicated) domains are “ordered” in that events, activities, problems, and knowledge within them are predominantly structured and well understood. The complex and chaotic domains are “unordered” in that situations, work, issues, and knowledge within them are predominantly unstructured and not well understood. The central domain represents “disorder.” It is a region of confusion and conflict among decision makers who perceive and interpret an event, situation, problem, or issue differently. Kurtz and Snowden (2003) state: “Those most comfortable with stable order seek to create or enforce rules; experts seek to conduct research and accumulate data; politicians seek to increase the number and range of their contacts; and finally, the dictators, eager to take advantage of a chaotic situation seek absolute control” (p. 470). Reducing the extent of the domain of disorder about a situation, through collaboration and consensus greatly facilitates identifying the most appropriate approaches to decision making and actions.

⁴ We named the four quadrants as: common, complicated, complex, and chaotic, for alliteration to enhance their retention in memory.

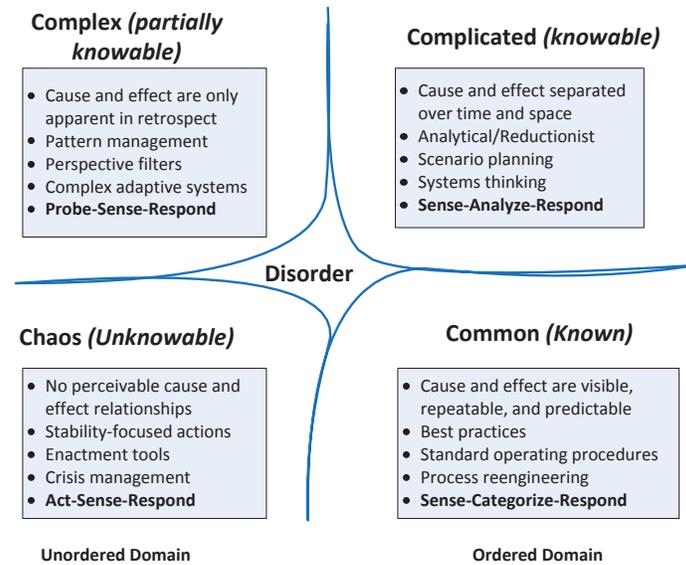


Figure 1. Cynefin Sense-Making / Classification Framework
(Adapted from Kurtz and Snowden, 2003)

The known (common) quadrant is the world of bureaucrats and administrators who use frameworks and guidelines to classify work and then rules and standards to process the work. The knowable (complicated) quadrant is characterized by codified professional knowledge that requires considerable skill and training to achieve consistent results when transferred to others. The complex (partially knowable) quadrant is the domain of scientists and executives in which tacit knowledge is not easily replicated by its practitioners and it is difficult to achieve repeated and reliable results. Finally, the chaotic (unknowable) quadrant is characterized by tacit knowledge that can range from belief, through experience, to expertise. It is difficult to identify what knowledge should be used and what should be discarded.

Situations may exist within any quadrant and organizations must be able to function in the most appropriate quadrant for each situation. Across the framework, organizational strategies range from sense-categorize-respond (*common*), through sense-analyze-respond (*complicated*), and probe-sense-respond (*complex*), to act-sense-respond (*chaos*). The position of situations, issues, or work in the Cynefin framework also determines what is possible in each domain: control, structure, patterns, and reaction, respectively. It will be shown that this has important implications for managing knowledge and knowledge work in each quadrant.

2.3.8 Current Framework Summary

Each of the seven organizational frameworks contributes to knowledge manageability. Collectively, these frameworks provide many useful organizing structures for knowledge manageability. In many cases, a number of the frameworks exhibit similarities in some aspects. Conversely, in portraying different perspectives of management, they also exhibit differences in some aspects. The main message from each framework is summarized below.

1. Different organizational functions need different business models for interaction between people and business units; each requires a different form of IT infrastructure for support.
2. Maximizing both business and IT efficiency and effectiveness without either one negatively impacting on the other requires negotiation between the two functions.
3. An organization has many attributes that differ substantially between industrial-era management and entrepreneurial approaches that will be needed in the knowledge economy.
4. Organizations are not monoliths. They can be viewed from a number of different perspectives or processes, each of which relates to part of the overall infrastructure.
5. Organizations are complex, adaptive systems. A systems approach is needed to understand and manage organizational processes from a holistic perspective.
6. Knowledge is both explicit and tacit and it is transformed from one form to the other as it flows from creation, to application.
7. There are four categories of sense-making, each of which requires a different approach to managing knowledge and knowledge work.

All of the messages described in the seven frameworks have been incorporated into the knowledge manageability framework.

2.4 Cynefin Framework

The Cynefin sense-making framework provides the core organizing structure for knowledge manageability. Therefore, three aspects of the framework are examined in greater detail in this section. First, we describe a number of attributes of the four quadrants. Then, we discuss the flow of knowledge across quadrant “boundaries.” Finally, we show that the framework can be interpreted from a number of different organizational perspectives.

2.4.1 Quadrant Attributes

The known (common) quadrant represents stability. It is characterized by knowledge that is generally accessible and agreed to by many people who have little personal investment in the action that results from it. This type of knowledge is often embedded in codified processes, it is transactional in nature, and it is amenable to automation. As a result, it is easily replicated and little skill is required to achieve repeated, reliable, and predictable results. This is the world of bureaucrats and administrators, who use frameworks and guidelines to classify work and then rules and standards to process the work. Best practices and resource-based project management work well in this quadrant. The most appropriate sense-making strategy in the known domain is to *sense, categorize, and respond*.

The knowable (complicated) quadrant represents flexible structure. It is knowable through the professional, specialized, or technical knowledge of experts and specialists. This quadrant is

characterized by knowledge that is accessible and agreed to by smaller groups of people who often have a personal investment in the action that results from it. Although codified, this type of knowledge is often transferred only through intensive study or lengthy practical experience. As a result, although it can be replicated by its practitioners, considerable skill and training may be required to achieve repeated, reliable, and predictable results by others. Here, the objective is to design, develop, implement, and manage flexible and modular functions, processes, and systems, using existing technical specifications, expertise, and explicit knowledge. Good practice and expert-based design, prototyping, testing, and modelling are the best approaches in this quadrant. These represent a sense-making strategy of *sense, analyze, and respond*.

The complex (partially knowable) quadrant represents significant uncertainty. Situations and issues can be only partially known or understood. This environment is characterized by knowledge that is accessible but not generally agreed to by a large enough group of people to be reliably replicated. This is the domain of scientists and executives who typically have a substantial personal investment in the action that results from the agreement or acceptance of their knowledge. Although knowledge in this dimension can be codified, codification does not guarantee its truth or acceptance. This type of knowledge is often transferred through dialogue, discussion, or debate between sometimes opposing views which may lead to its acceptance, marginalization, or being discredited. As a result, it is not easily replicated by its practitioners and it is difficult to achieve repeated, reliable, and predictable results. In complex situations, hindsight does not lead to foresight. To make sense of what happens in this domain, organizations must *probe, sense, and respond* in ongoing iterative cycles.

Finally, chaos is unknowable; its mantra is agility and adaptability. This quadrant is characterized by tacit knowledge held by individuals who have an emotional attachment to and substantial investment in the knowledge itself and any action that results from it. To the extent that such knowledge has been accepted as true and encoded for future use, it is individual and can be held equally by the unskilled as belief, the uninformed as bias, or the expert as opinion. As a result, it is difficult to identify what is of value and what is not and what is worth the effort to explore, develop, and codify and what should be ignored. In chaotic situations, agents are unconstrained and independent of each other. Although their behavior can be studied through statistics and probability, there are few discernable patterns or cause-and-effect relationships. Here, we are limited to “muddling through,” using an *act, sense, and respond* approach. That is, taking small actions, sensing the environmental response, and adapting actions to that response.

2.4.2 Flow Across Quadrants

The Cynefin framework is dynamic. Kurtz and Snowden identify a number of mechanisms that result in movement across domain boundaries (Figure 2). Although movement is more common across one boundary at a time (e.g., development, implementation), some processes can move across more than one boundary. For example, swarming begins unexpectedly in chaos, leading to analysis of a complex situation, resulting in a structured response, which is approved by the organization. Flow in both directions is equally possible and necessary. Clockwise flow towards the common domain supports embedding knowledge into work processes that increase organizational efficiency and into products and services for clients. Clockwise flow is necessary for short-term competitiveness. Counter-clockwise flow towards chaos enables organizational learning and adaptation which are precursors to long-term sustainability. Note that direct flow

from common to chaos generally indicates collapse (e.g., bankruptcy) whereas flow from chaos to common can be brought about by controlling a chaotic situation (e.g., imposing order).

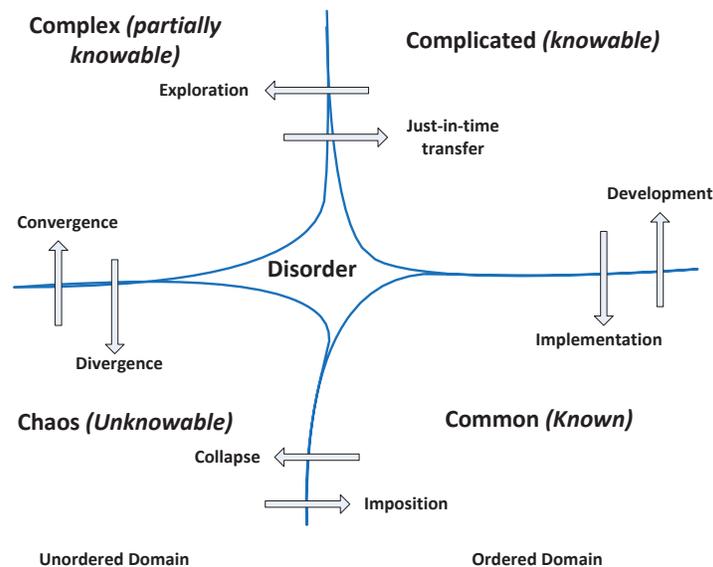


Figure 2. Flow Across Domain Boundaries in the Cynefin Framework. (Adapted from Kurtz and Snowden, 2003)

There is a natural tendency for individuals to want to cycle from the chaotic, through the complex and complicated, to the common domain. Pigeau (2004) argues that this is the result of the tension between individuality and the need for affiliation that balances an individual’s differences in knowledge structures with a need to share one’s knowledge structure. Indeed, the basis of the consensus criteria of truth acceptance explains the phenomenon that individuals, left to themselves, will gravitate towards other individuals with similar knowledge structures and belief systems. This results in the inevitable formation of emergent social groups around any socially sanctioned knowledge structure, no matter how radical or off-the-wall. From an organizational perspective, however, there is no preferred domain in the Cynefin framework. As previously noted, situations can exist in any quadrant and two-directional flow through all four quadrants is necessary to support both short-term competitiveness and long-term sustainability.

2.4.3 Framework Interpretation

The Cynefin framework is robust, enabling a broad range of interpretations. We consider two previously described frameworks (operating models and knowledge creation) and two perspectives (relationships and organizational).

In Figure 3, the Cynefin framework is interpreted in the context of the Ross et. al. (2006) operational model (section 2.3.1). In the unification quadrant, concepts have become so well understood and processes so clearly interpreted by the organization that they have been embedded in its infrastructure. Here, knowledge is embedded in the organizational “machinery.” If done well, there is no need for training other than how to do the work. Both processes and data

are highly standardized. This permits focussing on trends and core activity rather than on providing the information necessary to manage complicated transactional operations. Their replication quadrant has highly standardized processes and low standardization of data. There is sufficient agreement about concepts that knowledge can be replicated by a group of professionals or processes can be replicated across business units.

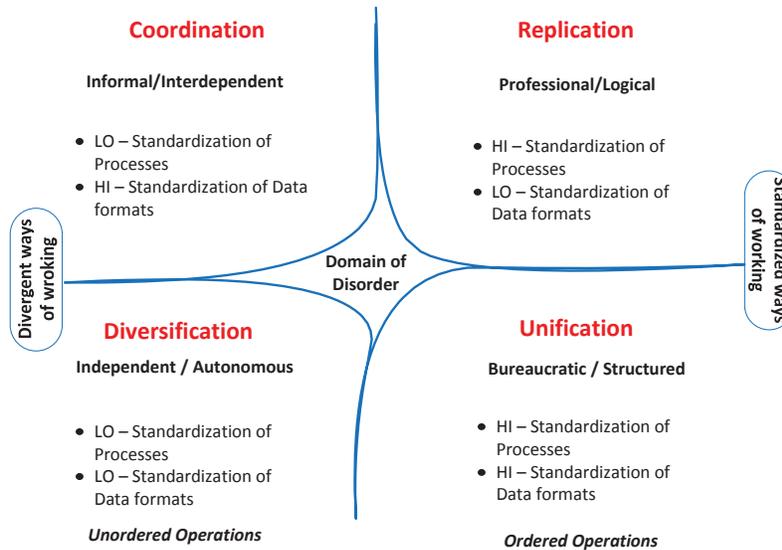


Figure 3. Cynefin Framework Interpreted from an Operating Model Perspective.

In contrast, their coordination quadrant has low standardization of processes but standardized data formats. People interested in a concept or idea work together to understand and define it sufficiently to enable discussion and developing consensus. Here information and data standards are agreed to and core information and data are easily shared across business units, ensuring a consistent view of core information across the organization. Their diversification quadrant has low standardization of both processes and data. Individuals have a sense of what they mean but in attempting to convey new ideas, concepts, or observations they must express them imperfectly using metaphors and analogies to existing concepts. This is where separate business units do different work and are loosely organized into a larger organization.

Most businesses operate in more than one quadrant and often in all four. Key management information is highly standardized between business units regardless of the business being conducted. Similar business units can use common processes and the processes and data necessary to meet reporting requirements can be unified across the organization. R&D and product development divisions may very well use common project funding and approval processes even though there is little coordination between the activities of individual projects that are free to explore and develop new insights, methodology, or products.

In Figure 4, the Cynefin framework is interpreted in the context of the Nonaka–Takeuchi (1955) knowledge creation model (section 2.3.6). In their framework, openly available knowledge stored in repositories or embedded in infrastructure is accessed and accepted through *internalization*. Through *socialization* knowledge in the mind of an individual is reformulated into a new idea through reasoning. This process can also be viewed as knowledge transfer

through learning. Through *externalization*, new knowledge is transformed into documents and other objects that can be accessed and structured by a limited cadre of people who understand it⁵. Finally, through *combination*, the documented knowledge is added to other knowledge available in repositories where it can be accessed by individuals to start another cycle of knowledge creation. This process can be also viewed as knowledge transfer through training.

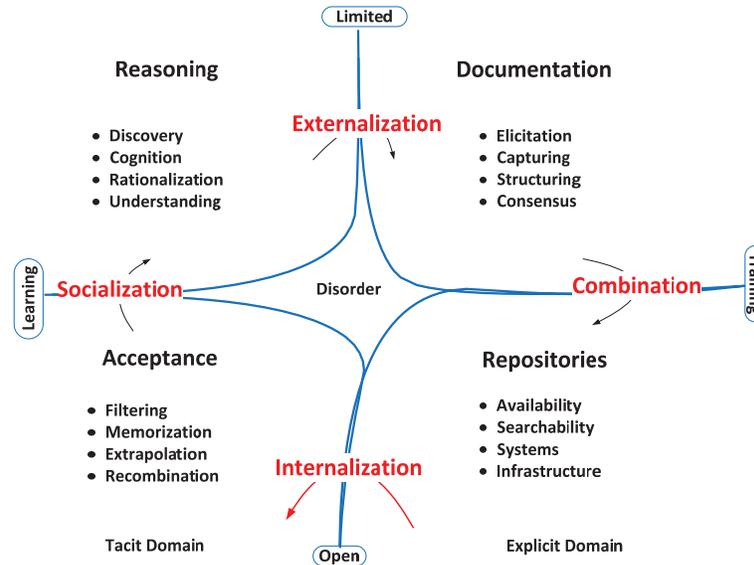


Figure 4. Cynefin Framework Interpreted from a Knowledge Creation Perspective

In Figure 5, the Cynefin framework is interpreted from the perspective of individual, group, and organizational relationships, which are central to managing knowledge. The lower-right quadrant represents authoritative and hierarchical relationships. Attributes of this quadrant are: authorized access, common language, roles and responsibilities, control and authority, and low personal involvement in how knowledge is used. This is the domain of bureaucrats and administrators. The upper-right quadrant represents professional and structured relationships. It can be characterized as: functional accessibility, professional language, common objectives, standards and processes, and moderate personal involvement. This is the domain of professionals and subject-matter experts. The upper-left quadrant represents informal and collaborative relationships. It involves domain accessibility, the use of symbolic language, conceptual agreement on theory and principles, negotiations and agreements, and high personal involvement. This is the domain of scientists and creative disciplines. Finally, the lower-left quadrant represents independent and autonomous relationships. It involves total accessibility, emergent language, individual perspectives, voluntarism and engagement, and very high personal involvement. This is a land of individuals, dialogue, and a struggle of thought.

⁵ In the manageability framework, externalization involves two steps. First, the new knowledge (individual learning) is expressed to others who validate it through dialogue (group learning). Second, it is documented and made available to the organization (organizational learning).

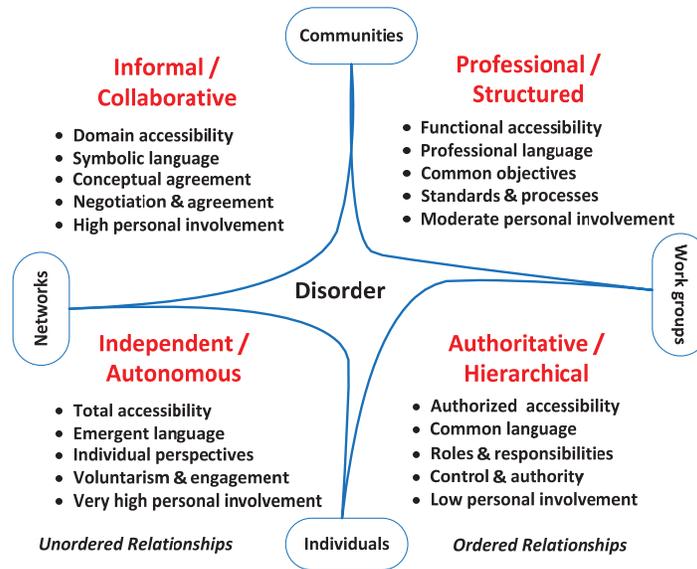


Figure 5. Cynefin Framework Interpreted from a Relationship Perspective.

Management must play very different roles in managing knowledge and knowledge work within each relationship domain. For example, in traversing the framework in a clockwise direction, beginning at the bottom, relationships shift from individuals to networks, to communities, and finally, work groups. The lower-right quadrant is primarily managed through authoritative hierarchy, using embedded knowledge, in the form of policies, rules, and procedures. The upper right quadrant involves transforming professional interpretation and opinions about complicated problems and issues into organizational structure. The upper left-quadrant employs negotiated agreements among scientists and creative employees to enable increased understanding of complex problems and issues. Finally, the lower-right quadrant uses responsibility autonomy to engage autonomous individuals to collectively discover patterns in apparent chaos.

In Figure 6, the Cynefin framework is interpreted from the perspective of organizational management because the purpose of knowledge management is to support the organization. Attributes of the control quadrant are: governance, roles and responsibilities, authority and hierarchy, goals and objectives, and decision making. In this quadrant, business units share the cost of common transactions and overhead. The coordination quadrant can be characterized as: business units, functional activities, structure and process, performance measurement, and design and development. In the coordination quadrant, business units achieve functional performance objectives. Collaboration involves: research and creative groups, knowledge creation, negotiation and agreement, analysis and synthesis, and discovery. In the collaboration quadrant, work groups collaborate on common objectives through joint production. The contribution quadrant consists of: individuals, engagement, autonomy, voluntarism, and emergence. In the contribution quadrant, individuals voluntarily contribute their knowledge, work, and experience.

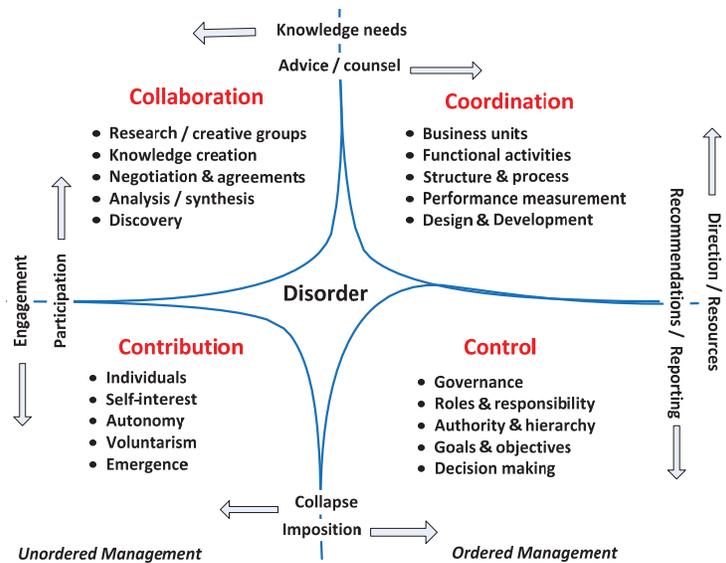


Figure 6. Cynefin Framework Interpreted from an Organizational Perspective.

Figure 6 also identifies processes that enable knowledge and knowledge work to cross domain boundaries. Control can collapse into anarchy⁶ (e.g., bankruptcy or closure) or it can impose working standards and processes to bring individuals into compliance. The control domain provides direction and resources to coordination which, in turn, provides recommendations and reports to control. Coordination provides knowledge needs to collaboration which, in turn, provides advice and counsel back to coordination. Finally, collaboration engages individuals in the contribution domain who, in turn, participate in collaboration activities.

The fact that a number of existing models can be adapted to the Cynefin sense-making framework and that the framework can be interpreted from a number of different perspectives attests to its robust, underlying generic nature. It can be used for a broad range of interpretations and uses. The fact that it originated from a knowledge management environment strengthens its specific applicability here. Consequently, although ideas from all the models described here have been blended into the knowledge manageability framework, the core is based on the Cynefin sense-making framework.

2.5 Operational Implications

The Cynefin framework can be used to identify appropriate approaches to knowledge management. Each quadrant is dominated by qualitatively different types of knowledge and knowledge work. The four quadrants are described in greater detail in this section.

⁶ Contribution refers to engaged individuals who achieve positive outcomes by participating in collaborative efforts. However, this domain also has a negative interpretation – anarchy, in which individuals are intent on destabilization for personal benefit.

2.5.1 Common

Much organizational work is based on common or routine knowledge and work processes. Such knowledge primarily requires training in procedures and methods. Work done under this rubric is generally well understood. Common knowledge is primarily explicit and relatively static; it is described in standards, guidelines, manuals, and through training dealing with tasks, processes, procedures, and other routine organizational activities. These generally permit relatively little interpretation in their application. There may be tacit elements, however, in the form of “tricks of the trade” or “work-arounds.” In fact, structured work often requires that people formulate and use ‘informal’ and ‘ad-hoc’ means to get work done.

Although complicated information technology and systems may be used to manage the volume of work, promote consistency, and communicate across distributed sites, there is little or no variability in the formal work processes, judgment required to do the work, or uncertainty of outputs. Although not central to knowledge management, common knowledge is very important to an organization. Without routine work and the associated know-how, an organization cannot function efficiently or effectively. As Ross *et. al.* (2006) indicate, to generate organizational agility, one has to codify routine information and processes and build the tools to make these transactions accessible and amenable to analysis so that the organization can focus on what is important and changing in its environment.

Examples of common information and knowledge work include:

- Administration (record keeping, purchasing, contracts);
- Human resources (hiring, training, evaluation, discipline);
- Operations (maintenance, scheduling, reporting); and
- Finance (budgets, expenses, account balances).

2.5.2 Complicated

Many functions, processes, or systems are complicated. They consist of many components with intricate cause-and-effect relationships or interactions, yet they are well understood and produce predictable outputs. Developing a spread-sheet program, designing a vehicle, or building a jet aircraft are complicated. A complicated knowledge environment normally requires interactions among professionals with formal education in a discipline such as computer science, engineering, finance, or medicine that is often associated with accreditation. Explicit aspects of complicated knowledge are codified in operating manuals, computer code, technical specifications, and scientific methods. Although work is based on known and documented technology and processes, significant tacit knowledge and judgment are often needed to research, analyze, interpret, and apply what is known to support specific decisions and actions. Operations research, information systems, decision support systems, expert systems, communities of practice, and professional associations are typically used to process complicated knowledge.

Examples of complicated knowledge work include:

- Laboratory analysis (e.g., chemistry, physics, biotechnology, electronics);

- Developing information systems (e.g., technology, computers, networks);
- Change management (e.g., communications, human resources, negotiating, culture); and
- Large-scale project management (e.g., logistics, coordinating, budgeting, evaluating).

2.5.3 Complex

The world is complex: it has always been so. However, it is only in the last half century that we have begun to scientifically understand the complex nature of the systems that surround us. Capra (1975) observes: “The natural world...is one of infinite varieties and complexities, a multidimensional world which contains no straight lines or completely regular shapes, where things do not happen in sequences, but all together” (p15). Prigogine (1984) states: “In the space of a few generations, the pre-Socratics collected, discussed, and criticized some of the concepts we are still trying to organize in order to understand the relation between being and becoming, or the appearance of order out of a hypothetically undifferentiated initial environment” (p38). More recently, Cambell (1993) indicates: “Complexity is ubiquitous. It is in nature as well as in artifice. It occurs in large and small systems. It can be tangible or intangible. To be aware of the existence of complexity is like feeling a ‘presence’ that virtually defies description” (xi).

Complex situations and problems may be highly sensitive to small, immeasurable changes in initial conditions. Alternatively, complex behavior can result from the interactions among many independent agents or components, coupled with positive feedback, system delays, non-linear relationships, clustered effects, and irreversibility of processes. Components of complex systems cannot be analysed independently of the system and their impacts must be considered in the context of the system as a whole. Complex systems may function far from equilibrium for long periods. Consequently, small stimuli can lead to unpredictable, irreversible jump-shifts in behavior, non-linear responses, or emergent states.

We can distinguish the behavior of complex systems and situations from complicated ones by: delayed or predictive feedback (causing oscillations from repeatedly overshooting targets), nonlinear responses to stimuli (causing sudden, irreversible jump-shifts), as well as self-organization and co-evolution (involving the independent actions of large numbers of “agents”). Complexity also includes concepts of self-similarity in patterns and change. In this regard, Mandelbrot (1983) completed the first extensive analysis of fractals – self-similar fragmenting of patterns that infinitely subdivide or aggregate. He noted: “Clouds are not spheres, mountains are not cones, coastlines are not circles, and bark is not smooth, nor does lightning travel in a straight line” (p.1).

In complex situations, the analytical challenge is to use conceptual knowledge to find patterns and understand underlying processes, to the extent possible. Science can only explain phenomena in general but cannot predict specific outcomes other than statistically. The management challenge is to use tacit knowledge and experience to enhance positive outcomes and to dampen negative ones. It must be understood, however, that in complex situations, hindsight does not lead to foresight.

Examples of complex knowledge work include:

- Innovation: (science & technology, research & development, commercialization);
- Advising (policy development, organizational positioning, recommendations);
- System integration (across organizational functions, domains, and levels); and
- Risk mitigation: (security threats, public safety, response to events).

2.5.4 Chaos

Beyond complexity lies the dimension known as chaos, where little is knowable and, consequently, predictable. Two conditions lead to chaos – either the components or the relationships among them are unknowable (e.g. no discernable cause-and-effect) or small variations in initial states lead to large variations of the final state. In the latter case, the initial state cannot be measured with sufficient accuracy to preclude large variability in the predictability of outcomes. In essence we can never know how small a difference will make a difference. Lorenz (1963) discovered that tiny variations of initial conditions led to large variations in the output of weather models, thereby demonstrating that long-term weather prediction is impossible.

Many situations such as turbulence, emergency events, or system failure are chaotic at differing levels. We cannot know precisely how air will flow around a specific obstruction, where or when an emergency will occur, or when a critical delivery will be delayed due to adverse weather or equipment malfunction. There are no clear or simple cause-and-effect relationships. Some causes can produce different effects due to extreme sensitivity to initial conditions (e.g., weather) or variable development processes (e.g. stem cells). We cannot predict the state of the weather, an economy, or a society beyond a near-term future or very broad trends. Although scenario analysis can consider possible consequences of potential events, precise prediction is not possible. In some cases, even statistics fail us as there is no basis for calculating the probability of occurrence of unique events (Talib, 2007).

Examples of knowledge work in a chaotic environment include:

- Predicting the occurrence of security or emergency events;
- Planning responses to unprecedented acts, events, or situations;
- Forecasting long-term socioeconomic trends; and
- Anticipating emergent technology.

3. Organizational Knowledge

3.1 Organizational Perspectives

From an organizational perspective, the fundamental question is: What can management do with or about different forms of knowledge and knowledge work to increase their value and productivity, respectively? What specific management decisions can be made and actions taken and what outcomes can be expected as a result? As the key resource of the knowledge economy, knowledge should be viewed as the core asset of any 21st century organization. The complexity of the problem suggests that a systems approach is the best way to address it.

An organization is an open, complex, adaptive system. A system is a structured set of

components that collectively use resources to do work that transforms inputs into outputs that achieve a common goal. An open system interacts with its environment to exchange resources, inputs, and outputs. An adaptive system is one that changes how it does work, the work that it does, and even its goals and objectives. We must describe (and where possible, quantify) system components and how they interact with each other. We must also understand the strategic role of knowledge as a resource that may be generated internally or be acquired from the environment. Further, we must understand the nature of knowledge and how it is used to achieve common goals. Finally, we must understand the purpose of knowledge as an output to the organizational environment.

Knowledge work is the heart of a knowledge organization. Knowledge work transforms inputs into outputs by adding value to content. The two great internal system variables are stocks and flows. How do we generate a stock of knowledge (assets), how much do we have, and how do we manage it? How does knowledge flow among the many organizational groups to enable different kinds of knowledge work by different functions? Finally, how are knowledge products and services transferred to the environment through knowledge markets?

An understanding of the full spectrum of knowledge and knowledge work and its appropriate management should be embedded at all levels of an organization and across the full range of its interests. It should rise from the depths of an organization's infrastructure to the peak of its business strategy. It should reach across the knowledge ecosystem of organizational interactions with its employees, clients, partners, and networks.

A common understanding of terms and their meanings is essential to a meaningful discussion. We use four definitions provided by Simard and Jourdeuil (2013).

- **Knowledge management:** Develop, implement, and operate a knowledge infrastructure that creates, manages, and uses knowledge to achieve organizational objectives.
- **Knowledge infrastructure:** People, using work processes and technology, within a governance framework to embed, advance, or extract value from knowledge.
- **Knowledge manageability:** Extent or degree to which the knowledge infrastructure can be mandated, governed, structured, and evaluated.
- **Management regime:** Pattern of management decisions and activities; characteristic organizational behavior or procedure; mode of governance or rule.

This set of definitions differs from those typically found in the literature. Here, knowledge management is defined in terms of managing a knowledge infrastructure. A knowledge infrastructure, in turn, supports embedding, advancing, or extracting value from knowledge. Manageability is the extent to which the process that people use to undertake knowledge work can be structured and measured. Finally, a management regime is a general management pattern and behavior. Collectively, these four definitions provide the foundation for knowledge manageability.

3.2 Management Regimes

The fundamental differences in the nature of knowledge and knowledge work in each quadrant of the Cynefin Framework implies that a uniform, standardized approach to management will be

less effective than one which is adapted to these differences. In some cases inappropriate management will be ineffective and even counterproductive. Further, as has been shown, knowledge flows across all four quadrants as it advances from creation to application. This is intuitively understood in science-based organizations, where for example, scientific experiments that create knowledge are managed differently from the budgets that enable the research projects, or the structured publication process that disseminates the results. But the different management approaches have not been previously described in the context of knowledge and knowledge work.

The management framework described here is an extrapolation of existing frameworks. For example, Machlup (1984) identified three sites of knowledge stocks:

- Knowledge embodied in physical tools or machines developed through internal research and development.
- Knowledge embodied in individuals who are educated in a domain or trained and skilled in a technology.
- Knowledge created and disseminated at a cost but not inseparably embodied in physical or human carriers.

Fairtlough (2005) proposed a “triarchy” theory of organizational governance. The theory states that there are three ways of getting things done in an organization: hierarchy (single rule), heterarchy (multiple rule), and responsible autonomy (self-rule). He describes responsible autonomy as self-government, self-organization, and the absence of external rule. Responsible autonomy does not mean a lack of accountability, however. Rather, instead of being externally controlled, outcomes are monitored by the organization and poor outcomes are not accepted or rewarded.

The knowledge manageability framework combines the ideas of Machlup and Fairtlough into four categories founded on the Cynefin framework. We define the categories in terms of four management regimes: authoritative hierarchy (explicit knowledge is approved and embedded in organizational processes), organizational structure (explicit knowledge is codified and interpreted to coordinate organizational processes), negotiated agreements (tacit knowledge is exchanged among individuals and communities), and responsible autonomy (innate knowledge is voluntarily used by individuals to create new knowledge).

- ***Authoritative Hierarchy:*** Knowledge creation, management, and use can be almost completely (>90%) mandated, governed, structured, and evaluated. Systems and processes containing embedded knowledge tend to be relatively rigid. Knowledge work is governed by organizational authority which determines how knowledge is produced and used. Examples include reporting to superiors, allocating a budget, assigning responsibility, or approving a project.
- ***Organizational Structure:*** Knowledge creation, management, and use can be predominantly (50%-90%) mandated, governed, structured, and evaluated. This regime emphasizes an organization’s ‘structural capital’ – the material and processes that the organization ‘owns’ or is licensed to use (Edvinson and Malone, 1996). Management focuses on the context within which explicit knowledge is used and knowledge work is

done on behalf of the organization. This region may be primarily governed by a domain or profession which determines how knowledge should be interpreted and used. Examples include designing, developing, or implementing work processes, products, or services.

- ***Negotiated Agreement:*** Knowledge creation, management, or use can be partially (10% - 50%) mandated, governed, structured, and evaluated. Tacit knowledge and knowledge work are collaborative; they are governed through negotiated agreements. Note that negotiated agreements are used internally as well as externally. Even within the context of formal or informal agreements, there is always substantial flexibility in the manner and extent to which knowledge work is done. Examples include: undertaking science, implementing policies that shape conditions for sharing, collaborating to jointly produce a document, or providing advice.
- ***Responsible Autonomy:*** Knowledge creation, management, and use can be minimally (10%<) mandated, governed, structured, and evaluated. Knowledge work is guided through engagement, including autonomy, mastery, and purpose (as they are internalized to serve organizational needs). In this regime, individuals or communities have autonomy to decide what to do. Responsibility is understood as accountability and is, therefore, not anarchy. This is consistent with tacit knowledge and knowledge work being innate within an individual. Therefore, people are self-governed through responsible self-interest and voluntarism. Examples include: allowing employees to determine what they do with part of their time and enabling self-motivated engagement in creative work.

Responsible autonomy is the vaunted self-synchronization that is seen as arising from the concepts of network-enabled or network-centric operations, where all participants know what is expected, what needs to be achieved, their part in the overall structure and who react without direction to changes in the situation as they become aware of it. It is also an embodiment of the just-in-time delivery model whereby partner companies share production plans and schedules with suppliers so that they can make available the needed components in time for production to continue unabated. In both cases, trusted exchanges are established between the agents involved in delivering various services and capabilities necessary to achieve objectives.

It should be apparent that the most appropriate and predominant core management regime for an organization is based on many factors ranging from an organization's business and culture to particular situations. It also depends on the nature of the work being done, and the type of knowledge involved. Finally, the nature of organizational interactions, such as intervention, partnership, collaboration, or advice play a significant role. Although most organizations have predominantly one business or culture, their internal interactions normally involve multiple types of work and relationships across most, if not all four regimes.

For example, in the public sector, developing a policy requires experience to anticipate probable outcomes of different policy alternatives, analytical skills to quantify the outcomes, and judgement to compare the desirability and value of the outcomes. Once developed, it must be implemented in a way that is consistent with the context in which it will be used.

Consequently, for most organizations or groups of organizations, knowledge management requires the application of more than one management regime, if not all four, to achieve

organizational objectives. In a science organization, it is essential to balance the four management regimes to achieve the necessary interplay between innovation and management and between administration and creativity.

There is a strong relationship among the primary purpose of management regimes, their motivation, focus, organizational interactions, sense-making, types of knowledge, and operating models. Table 2 lists overall attributes that describe and distinguish the four management regimes. Detailed lists of terms from which the overall attributes in Table 2 were derived are presented as “semantic data” by Simard and Jourdeuil (2013). Boundaries between the regimes are more transitional rather than categorical in that many descriptors span more than one category. They are classified based on relative appropriateness or primary applicability. The value of Table 2 is not the specific position of individual terms, but the overall shift of patterns from fully structured to virtually unstructured management environments.

Table 2. Overall Attributes of Four Management Regimes

Management Regime	Authoritative Hierarchy	Organizational Structure	Negotiated Agreement	Responsible Autonomy
Primary Purpose	Control	Coordination	Collaboration	Contribution
Key Process	Authorizing	Structuring	Validating	Creating
Emphasis	Objectives, Tasks	Resources, Direction	Connectivity, Interactions	Environment
Organizational Interactions	Line authority	Functional authority	Partnership	Network
Operating Model	Unification	Replication	Coordination	Diversification
Motivation	Extrinsic	Success	Mutual interest	Intrinsic
Sense Making	Common	Complicated	Complex	Chaotic
Knowledge Type	Authoritative	Explicit	Tacit	Innate

It is useful to examine the management regimes in the context of a research and development agency, for which they were initially developed. Scientific enquiry may be triggered by a question from a client or an inspiration about a potential use of knowledge, an object, or a system. Science begins with an idea in the mind of a scientist. This originates in their innate ability to envision new possibilities and relationships in the chaotic quadrant. Clearly, this can only be “managed” through responsible autonomy. Although an idea can be made explicit by formulating a hypothesis, this is not explicit knowledge. A hypothesis is a supposition, a possibility, an intelligent guess that provides criteria for evaluating and demonstrating the validity of the idea. A proposal is submitted for funding under the authoritative hierarchy in the common quadrant. A funded project requires a plan (organizational structure), involving a negotiated agreement between the organization and the scientist. Executing the plan – experimental design, conducting an experiment, and analyzing the results involves tacit knowledge and complex work.

When an experiment is completed, the results are made explicit by writing a scientific paper, disseminating it to the global science community through publication, and making it accessible by adding it to library holdings (beginning the transfer to the complicated quadrant). This is normally managed through an organizational structure. Project data, reports, and administration are incorporated into organizational records that fall under authoritative hierarchy. Finally, some scientific knowledge may be embedded into internal policies or regulations or external products and services as authoritative knowledge, completing the transfer from the complicated to the common quadrant.

The organizational implications of the four manageability regimes are described in greater detail in the following sections.

3.2.1 Authoritative hierarchy

Authoritative hierarchy controls subordinate decisions and actions. Motivation is based on compliance through extrinsic incentives (e.g., compensation, performance reviews, penalties) tied to objects and tasks. In this regime, knowledge generally requires formal review and approval to be embedded into organizational infrastructure, products, or services. Authoritative knowledge defines a formal organizational “position.” The knowledge is common because it is fully structured, codified, and embedded in the infrastructure. Authoritative knowledge is relatively inflexible because once embedded, a complete review, development, and approval cycle is needed to revise the infrastructure.

This regime is an industrial era organizational structure. Some to substantial aspects of most organizations, particularly the military and law enforcement continue to be managed through this approach. This is the domain of transactional processing and performance measurement. Efficiency and productivity are measured in terms of costs, time, and effort. Ross et. al. (2006) identify this as the foundation for execution that every organization needs to become truly effective and agile.

Authoritative hierarchy derives its mandates from legal instruments, such as a constitution, laws, or regulations. Authoritative hierarchies may also be externally imposed (e.g., policy, regulation, standards). Governance is achieved through control, restrictions, and penalties. Typical functions include enforcing compliance, responding to undesired events and maintaining privacy and security. Hierarchies monitor activity, mitigate risks, and measure outputs. Attributes include: mandatory requirements, inflexible structures, and prior approval of actions.

Authoritative knowledge has been approved for internal use within an organization or for external use by others in cases of legal or regulatory control. Alternatively, it has been accepted as true by decision makers. It is embodied in rules, mechanisms, or facts that are embedded in the organizational infrastructure (governance, processes, tools, technology). It can be transparently shared and reused by those who need it because it has been codified and analyzed in a business context to ensure that it is collected, coordinated, used, and recorded with minimum effort. Authoritative knowledge is transferred throughout an organization through means such as reports, communications, or dashboards.

This regime emphasizes highly structured, rigid organizational architectures based on content that has been embedded into relationships, processes, products and services. Toolsets and training on how to use them are a key means of knowledge transfer. There is minimal need or opportunity for interpretation to enable use. Examples include data, records, computer programs,

and system architecture. Attributes include formal reporting relationships and approval, inflexibility, and mandated activities. The stock of knowledge is managed through methods such as: being embedded, training, and measurement,

Work flow begins by examining a situation, evaluating alternative courses of action, and making decisions. It then provides authority, responsibility, and resources to support the work. This regime determines what knowledge work will be done and what knowledge will be embedded into the organizational infrastructure. Decisions are based on organizational priorities, structured explicit knowledge, negotiated agreements between business units, and emerging knowledge from responsible autonomy. This is followed by developing work processes and systems to do the work. These are implemented through communication, training, promoting their use, and support. Finally, the systems and processes are operated, maintained, and upgraded to increase their utility or efficiency

3.2.2 Organizational Structure

Organizational structure provides the basis for organizing and coordinating functions across an enterprise. Organizational structure adds value through its capacity to deliver quality, trusted data and information in near real time to those who need and use it. Motivation is based on measurable success criteria (e.g., productivity, effectiveness) organized through resources and decisions. It is the primary regime for generating, managing, and using explicit and complicated knowledge. It is also the means for formally expressing and transferring explicit knowledge or capturing and codifying it in reproducible media (e.g., scientific publication, after-action report). This knowledge is somewhat flexible in that it can be superseded by new or improved knowledge and is subject to interpretation by those receiving it. The knowledge is generally complicated because it involves interactions among many elements and interpretation by experts to result in reproducible actions. Organizational structure may apply to a single organization or a group of organizations.

This management regime underlies most contemporary organizations. Organizational structure is implemented by decision making, delegating authority, assigning responsibility, and allocating resources. This is a domain of balancing the resource needs of business units to maximize overall organizational performance. Governance is through direction, integration, and coordination. Management functions include developing, implementing, and managing projects and programs. Structure is evaluated through efficiency, productivity, and organizational outputs. Attributes include centralization, planning, and running the business. Weill and Broadbent (1998) identify this as the *raison d'être* for the effort that organizations must undertake to capitalize on their IT investment. Ross et. al. (2006) identify this as the core area surrounding the balance between their four operating models. This is a realm of transition from complicated knowledge to common knowledge and of the transition from unstructured information towards data management and from manual to automated processes.

Organizational structure focuses on the interpretation of functional or domain-based explicit knowledge that is owned by or available to an organization and that often requires significant education to understand and analysis to usefully serve the organization. Examples include statistics, documents, presentations, and libraries. Attributes include either physical or electronic media, intellectual capital, captured, organized, and storable explicit knowledge. The stock is increased through collection, tabulation, production, or development, among others. Explicit

knowledge is fully transferable through transactions that include: giving, licensing, exchanging, or selling.

In this regime, knowledge tends to be a synthesized entity (advice, recommendations, analyses, know-how) that reflects the intellectual capacity of an organization. In most cases, value is derived by applying a repeatable approach to different problem sets to achieve consistent, repeatable results. Organizational structure tailors generic processes and expertise to the organizational environment to develop context-specific interpretations of phenomena, practice, and rules to produce recommendations for specific situations.

Work flow begins by formulating and collating explicit knowledge. Raw data must be transformed into information and explicit knowledge to produce products and services. There are many ways to do this, including: analysis, adaptation, or synthesis. Often, problems or opportunities arise through external drivers that impact the organization. Information and knowledge assets are preserved through being captured, organized, stored, made accessible, and migrated through structural and technological change. Finally, the assets are related to organizational needs through an inventory, knowledge map, and leveraging.

3.2.3 Negotiated Agreement

Negotiated agreement is intended for collaboration among employees and partners or enabling the management of tacit knowledge. Motivation is based on qualitative collaboration criteria (e.g., participation, connectivity, teamwork) supported and facilitated through connectivity and interactions. Partners are persons, groups, or organizations with legal, contractual, or mutual agreements to cooperate in achieving common objectives as principles within an association, organization, or group. Partnership knowledge is generally complex because of uncertainty in the issues under consideration or the difficulty of eliciting it from individuals. Managing tacit knowledge within an organization is similar to managing knowledge in partnerships, although agreements are administered very differently in each case.

This management regime has existed since the origins of trade and commerce, but is becoming increasingly central to the knowledge economy. This is a domain of negotiation, sharing, collaboration, and peer production based on trust and mutual respect that is defined through formal or informal agreements. Agreements arise through negotiated contracts, mutual agreements, and community participation. They are governed through leadership, support, and community structures. Primary functions include collaboration, facilitation, and sharing. Agreements can be evaluated through connectivity, exchange transactions, and participation. Key attributes include mutual interest, enforceability, and trust. Weill and Ross (2009) identify this as the *raison d'être* for governance in that organizations need to negotiate agreement between business and IT leadership. Strategically, this is the realm of negotiations between business units over what is important and deserves investment and what effort should be devoted to transforming tacit knowledge and ways of working into explicit ones (coordination model). Operationally, it is the realm of negotiations between managers and employees doing knowledge work over what work will be done and how resources will be allocated.

Negotiated agreements are based on sharing tacit or explicit knowledge owned or held by more than one organization or individual and that can be brought to bear on joint or collaborative work within the context of an agreement. Examples include: patents, processes, resources, skill, and lessons learned. The stock can be increased through various methods, including: research,

acquisition, experience, or learning. Tacit knowledge is partially transferable through sharing, interactions, conversations, or dialogue.

Work flow begins with the exchange of knowledge. This involves a transaction, delivery, facilitation, and uptake. Partnerships require connectivity among individuals, groups, communities, or networks. Once connected, participants collaborate through conversations, sharing, and learning to jointly produce knowledge products. Finally, knowledge is interpreted, adapted, and applied to knowledge work.

3.2.4 Responsible Autonomy

Responsible autonomy is central to intrinsic motivation of individuals and for encouraging sharing of tacit and inherent knowledge ‘owned’⁷ by employees. Motivation is based on intrinsic criteria (e.g., recognition, respect, acknowledgement) enhanced by an environment that is conducive to creativity. Innate knowledge is part of the essential character, constitution, and nature of an individual (e.g., intelligence, creativity, talent). Although it can usually be enhanced, it cannot be transferred. Here, the emphasis is on the intrinsic motivation of individuals and a capacity to elicit it – through responsible autonomy within a network environment. Inherent knowledge is chaotic because it is unknowable and it enables unpredictable emergent knowledge and capability that cannot be expressed. Eliciting participation from an external volunteer involves similar techniques to eliciting creativity from an employee.

Innate knowledge is used here as a subset of Polanyi’s (1962) implicit knowledge. Implicit knowledge is more general in the sense of knowledge that is part of the essence or nature of something, whereas innate knowledge implies presence in an individual from birth; e.g., an inborn talent, aptitude, or proclivity. Although similar, inherent knowledge emphasizes inheritance, whereas such knowledge is only potential at birth; it must be enhanced through learning and mastered through practice. Hamming (1997) discusses innate knowledge from a computer programming perspective: “To what extent can great writers be taught? Shakespeare and Jane Austen did not take creative writing courses, and most people who take creative writing courses do not end up among the greatest writers. All that programming courses can do, apparently, is make poor programmers a bit better. Experience, while necessary, seems not to be enough” (p. 68). From another perspective, innate knowledge differentiates between people who excel at analysis and those who excel at synthesis. Alternatively, it is the difference between “structured” thinkers and “unstructured” thinkers. Few people are good at both.

Innate knowledge is related to talent. From an organizational perspective, talent is a naturally recurring pattern of individual thought, feeling, or behavior that can be productively applied. Elbaz (2012) indicated that talent accounts for half of an individual’s productivity, with fit to the job, experience, and education collectively accounting for the other half.⁸ He describes a five-component model for talent: motivation to succeed, ability to influence others, structured work style, interpersonal relationships, and capacity to reason. He notes that people operating from talent learn faster, are more productive, and build stronger relationships. They also have lower rates of absenteeism, better safety records, and stay with the organization longer.

⁷ In this case ownership is loosely defined as individual knowledge not yet shared with others.

⁸ Jonathan Elbaz - Using Engagement to Maximize Performance in the Public Sector, pres to: INFONEX Conference on Public Sector Human Resource Management, Ottawa, On. Jan 31-Feb 1, 2011.

Responsible autonomy is an emerging management regime founded in network structures that enable a collapse of communication and coordination costs. This domain is founded on self-organization, self-motivation, and flexible priorities. It is based on intrinsic motivation, voluntarism, and accountability. It is moderated through community-based codes of conduct or rules of behavior. Management functions include recognizing, enhancing, and harnessing intrinsic motivation. Responsible autonomy can be evaluated through active membership and collective benefits. Attributes include peer production, intrinsic motivation, professionalism, and synergy. This is where emergent knowledge is born, lives and sometimes dies. This represents the chaotic dimension of knowledge and the diversification model. It also represents chaos and the unknowable in an IT infrastructure. Knowledge is tacit and, at its inception, it is not shared. This is the area in which the brilliant and the not-so brilliant create new ideas and concepts and in which they first begin to be socialized, looking to attract resources in the organization to start them on their journey towards consensus, codification, and institutionalization.

Responsible autonomy encourages individuals to self-organize, or gravitate towards other individuals with similar knowledge, to create new knowledge. Examples include: wisdom, judgment, intelligence, or creativity. Attributes include constitutional, natural, or essential characteristics of an individual. The stock of knowledge originates through being embodied, inherited, or inherent talent. Innate knowledge is not transferable, although it can be modeled or copied as it is demonstrated, displayed, or performed. It is often based on the combination of explicit knowledge and internalization in the context of new problems or questions that give rise to new ideas.

The responsible autonomy dynamic has the potential to entice members of the organization to contribute the knowledge they glean through their external connections and networks that are not sponsored by work. Organizations must create an environment that values the insights provided from non-traditional sources, and encourages members of the organization to contribute their insights related to a problem without regard to whether it is their job or not. The structures that are necessary to make this happen include those that facilitate a broad sharing of information and problems; and those that allow interested parties to subscribe to issues or topics that interest them so that they can volunteer their expertise when it matters.

Work flow begins with individuals who volunteer to use their inherent knowledge to undertake knowledge work. This is where problems or opportunities often arise. Activity may be based on intrinsic motivation, altruism, or professionalism. Management is limited to supporting enabling conditions, such as encouraging, stewarding, or engaging individuals. This results in the creation of new knowledge which then begins to flow back through tacit, to explicit, and sometimes to authoritative knowledge, thereby completing a cycle that began with a mandate to undertake knowledge work.

3.2.5 Strategic Implications

The types of knowledge and knowledge work that are most important for short-term competitiveness are very different from those that support long-term sustainability (Figure 7). An organization's knowledge assets and the structured work that transforms them into products and services supports short-term organizational competitiveness (authoritative hierarchy, organizational structure). Conversely, individual abilities and the capacity to create new knowledge support long-term organizational sustainability (negotiated agreement, responsible

autonomy). An organization must balance knowledge management activities between short-and long-term goals. The specific proportions will depend on the nature of the organizational environment. As the environment becomes increasingly dynamic, the appropriate balance shifts from maximizing the value of existing knowledge to increasing the capacity to create new knowledge.

This suggests two overarching knowledge management goals.

1. Facilitate knowledge flow towards the structured end of the management spectrum, where it can be embedded into organizational products and services to enhance competitiveness.
2. Provide an environment that is conducive to creating and validating emergent knowledge at the ephemeral end of the management spectrum to enhance sustainability.

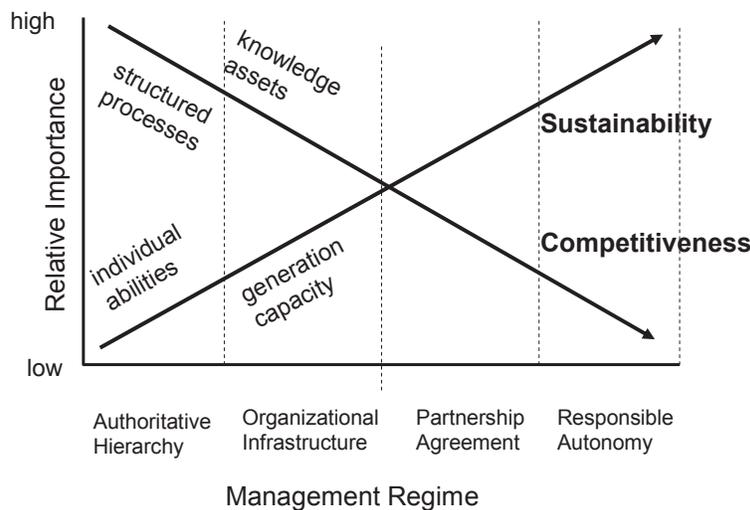


Figure 7. Knowledge Manageability Strategic Trends

Overall, the knowledge manageability framework encompasses a spectrum that ranges from dynamic, unstructured environments to relatively inflexible, highly structured environments. It provides a robust, multi-dimension framework for managing all types of knowledge and knowledge work across diverse organizational environments. Moving across the knowledge management regimes reveals significant contrasts in the most appropriate types of knowledge, knowledge work, and their corresponding management.

4. Knowledge Flow Across Regimes

Knowledge is not static; to be useful, it cannot remain in one place. It is the lifeblood of an organization – flowing both vertically and horizontally. Stop or impede the flow of knowledge and an organization cannot function, or it functions poorly, at best. Knowledge not only flows, but also changes both its form and content as it moves from person to person and place to place. This section describes how knowledge flows across the four management regimes as it is transformed from innate to tacit, to explicit, to authoritative.

Knowledge flow is defined here from a systems perspective of the aggregated circulation or movement of knowledge through a series of steps or processes in a value chain, system, or organization. The focus of knowledge flow is sequential, small-scale transfer within or among individual elements of the knowledge infrastructure (people, governance, processes, or systems) which, taken together, move knowledge from creation to application. Much of what is discussed in this chapter is referred to in the KM literature as knowledge transfer. We define knowledge transfer as the act, process, or instance of conveying, copying, or causing knowledge to pass from one person, place, or situation to another. Although that definition could apply here, we use knowledge transfer in a macro sense of knowledge transactions between autonomous organizations, through knowledge markets, which are outside the scope of this chapter.

Organizational success requires an asymmetric two-way flow across the four management regimes. The flow is asymmetric because it must be actively transferred (“pushed uphill”) from innate to authoritative whereas flow in the other direction is more enabling (“natural, downhill”). This section describes active transfer techniques for engaging the use of innate knowledge to create new tacit knowledge, validating tacit knowledge and making it explicit, harvesting community knowledge to structure it, and making explicit knowledge authoritative.

4.1 Engaging Innate Knowledge

Innate knowledge is part of the essential character, nature, or intellect of an individual. It is determined by factors present in an individual from birth. It is often viewed as a natural talent, aptitude, or ability to do certain things. Innate knowledge can be enhanced through training and practice, but it cannot be transferred; it can only be used by the individual who has it. As indicated previously, using innate knowledge and sharing tacit knowledge depend on voluntarism more than anything else.

There are many ways to engage individuals. Drawing from Aristotle’s three modes of persuasion (ethos, pathos, and logos), Paul McDowall classifies engagement into three categories: intellectual, social, and emotional. He notes, however: “Engagement is not a clean, sterile topic, and it cannot be mapped onto a neatly organized flow chart. It is by definition organic; it is about individual wants, needs, hopes, and dreams.”⁹ Stephanie Barnes observes: “Individuality (e.g. psycho-sociological issues, education, personal ability), time (when the action takes place) and space (e.g. culture, habits, organizational issues, industries) should be taken into account.”¹⁰

Stoykyo (2010) identified three approaches to incentives. They are summarized in terms of individual and organizational outcomes in Table 3. In moving from compliance to engagement, individuals shift from behavior (what you do), through attitudes (what you think), to willingness (how you feel). That is, from observable, external, interpersonal responses to unknowable, internal, desirable responses. Similarly, organizational results shift from functionality (do the work) through productivity (do it efficiently), to creativity (do something new). That is, from hard, measurable, and enforceable to soft, subjective, and recognizable.

⁹Paul McDowall, Personal communication, Oct. 22, 2010

¹⁰Stephanie Barnes, Personal communication, Oct. 22, 2010

Table 3. Individual and Organizational Outcomes of Different Approaches to Incentives

Approach to incentives	Individual response	Organizational results
Compliance	Behavior	Functionality
Motivation	Attitudes	Productivity
Engagement	Willingness	Creativity

Compliance emphasizes extrinsic incentives, such as pay, job security, duty, work ethic, and penalties. There is a clear role for compliance in areas such as manufacturing, the military, the law, regulation, and policies, but it results in quota-based, standard results and no change. Motivation emphasizes managing people through incentives, such as ambition, challenges, bonuses, rewards, and recognition. There is an important role for motivation in increasing organizational efficiency, productivity, and quality, but improvements tend to be more quantitative than qualitative – that is, evolutionary. Engagement emphasizes intrinsic incentives such as meaningfulness, sense of ownership, self-esteem, enjoyment, and self-satisfaction. Through engagement, people personally commit to and become truly involved in a task or activity. They do so not because it is asked of them, or they expect something, but rather because they want to; because they enjoy doing it. Engagement can lead to revolutionary changes.

Gallup (2012) defines engagement as the degree to which an employee is psychologically committed to their work.¹¹ They found a significant positive relationship between the level of engagement and the probability of above-average performance. They also found significantly lower turnover and fewer accidents among engaged employees. They note, however, that only 20 percent of Canadian workers are engaged, about two-thirds are not engaged, and the remainder are disengaged. They described an engagement framework comprising basic needs, individual contributions, teamwork, and growth.

Fencil (2008) lists ten steps that managers can take to increase employee engagement and create a positive attitude. The actions incorporate both motivation and engagement approaches to incentives, although the author emphasized the benefits of engagement in terms of employee productivity rather than creativity.

1. Reflect and recharge – identify your position on the engagement spectrum.
2. Hire “engageable” employees - people who enjoy and are good at the work to be done.
3. Earn trust continuously – it is an essential precursor to engagement.
4. Stress employee ownership – they must feel personal success in the effort.
5. Clarify goals – the team must understand their roles in the overall effort.
6. Feedback is a gift – provide it frequently to team members.
7. Talk and listen more – frequent dialogue generates ideas and reduces misunderstandings.

¹¹ Gallup Consulting, pres. to INFONEX Public Sector Human Resources Management Conference, Ottawa, ON, Jan. 31-Feb.1, 2012

8. Match projects, passion, and proficiency – this positively influences job satisfaction, commitment, and contributions.
9. Know your team – their position on the engagement spectrum (see #10).
10. Tailor coaching strategies – for the:
 - Engaged*: nurture, recognize, stretch, develop, and keep involved.
 - Almost engaged*: provide feedback, resources, and opportunities to excel.
 - Underachievers*: clarify priorities, expectations, success criteria, and provide guidance.
 - Disillusioned*: take stock of feelings, clarify success, provide resources, and opportunities.
 - Disengaged*: take stock of individuals, clarify expectations, and provide interesting work.

Tosti and Nickols (2010) contrast between positive signals that can be sent by managers to promote engagement and negative signals that can inadvertently damage it.

1. **Value** – *Positive*: Agree how both parties benefit, commit time to interaction, listen, ask questions about their ideas, ask for help and advice. *Negative*: Seldom interact, don't invite people to planning meetings, ignore suggestions and ideas.
2. **Honesty** – *Positive*: Jointly review progress and performance, freely share helpful information. *Negative*: Close monitoring, tight controls, withholding information.
3. **Ability** – *Positive*: work together, mutual clarity of expectations. *Negative*: Close monitoring, tight controls.
4. **Judgment** – *Positive*: Delegate decision-making authority, ask to be kept informed. *Negative*: Require approval for every decision.
5. **Sincerity** – *Positive*: Mutual, up-front agreements, including changing assignments. *Negative*: Use overly-tight contracts, withhold information.

“Incentivizing” knowledge workers is evolving from the industrial-era concept of compliance to a knowledge-era concept of engagement. However, the idea of engaging knowledge workers to encourage them to willingly volunteer their innate aptitudes and abilities to enhance creativity in the workplace is currently at the cutting edge of KM. Borrowing a typical phrase found in most science papers – more research is needed in this area.

4.2 Capturing Tacit Knowledge

In addition to using tacit knowledge to accomplish individual goals and objectives, it is also important to transform it into explicit form so that it can be preserved as an asset for reuse. Savage (1996) observes: “Too often...learning disappears into the ether with no net to catch it. Yet it is an invaluable corporate asset. One of the challenges of the knowledge era is to capture individual and team learning on a continuing basis, making it available to others in the enterprise. “Time-to-learning” is as critical as “time-to-market” (p. 69). Further, as noted by Dalkir (2005), “Unless knowledge is embedded into corporate memory, the firm cannot leverage knowledge held by individual members of the organization” (p. 81). However, it must be recognized at the outset that much tacit knowledge cannot be made explicit.

Capturing tacit knowledge begins by identifying and prioritizing what should be captured. Attempting to capture everything is both unnecessary and infeasible. Some tacit knowledge is held by many individuals and doesn't need to be captured. Other knowledge loses its value

rapidly and there is little point in attempting to capture it. Not all experience is equally important and emphasis should be on the highest-priority knowledge. Clearly, mandate-critical knowledge held by one individual should be continuously captured and updated, whether or not that person is planning to leave or retire. The consequences of unexpectedly losing such knowledge could be substantial. Core expertise held by one or a few individuals should also be captured and updated as significant milestones are accomplished. Important lessons learned and best practices should be documented and disseminated as they occur.

Dalkir (2005) summarized several methods of capturing tacit knowledge to transform it into explicit knowledge.

Structured interviews – involve specific goals and questions for a knowledge acquisition session. The interviewer needs good communication skills, an ability to conceptualize, and a good grasp of the subject. Both open and closed questions are used. The former provides context and responses that were not specifically asked for while the latter helps to structure the response. “Reflective listening” (paraphrasing, clarifying, summarizing, and reflecting feelings) helps to clarify the meaning of what the expert said.

Stories – are narratives of management actions, employee interactions, and organizational events that are communicated informally. Stories provide a rich context that results in retaining the memory longer than information without context. Stories can increase organizational learning, communicate common values and rules, and serve to capture, code, and disseminate tacit knowledge.

Being told – an interviewer observes and analyses a task, process, or protocol. There is an ongoing interaction between the interviewer who states and refines his or her understanding and the interviewee who clarifies and validates the knowledge. The interviewee “thinks aloud” as they undertake the work and the interviewer notes the information used, questions asked, alternatives considered, decisions made, and actions taken.

Observation – While an expert addresses a problem or undertakes a task, an observer watches, usually accompanied by an audio or video recording. Although the underlying knowledge cannot be observed, the overt actions of the expert can be. Such recordings form a permanent record of how a task is accomplished.

Ad hoc sessions – rapidly mobilize a community of practice or a professional network to assist a member. These often take the form of short brainstorming sessions.

Road maps - are facilitated problem-solving meetings that follow a predetermined agenda. They are used to resolve day-to-day problems in a public forum which can lead to guidelines and standards for continuous process improvement.

Lessons learned – capture tacit knowledge in group settings. They document a structured retrospective history of significant events that occurred in an organization’s recent past, as described by the participants. Lessons learned involve planning, reflective interviews, distillation, documentation, and dissemination.

Action learning – is based on learning by doing. Small groups meet regularly, brainstorm alternatives, try out new things, report on progress, and evaluate the results. This is well-suited to narrow domains and specific issues.

E-learning – is capturing tacit procedural knowledge and its evolution, transforming the information into online courses, and posting them in computer-based training systems. Individuals may then be encouraged or required to take the course.

Learning from others – relates to external benchmarking. That is, learning about best practices of others, through publications or site visits, and adapting and adopting these practices. Benchmarking helps to identify better ways of doing things.

4.3 Harvesting Community Knowledge

The purpose of harvesting community knowledge is to make it available to the organization. Harvesting accesses knowledge that has already been made explicit by the community. If the knowledge of interest is tacit, methods of capturing it from individuals or groups are discussed in the section 4.2 (capturing tacit knowledge).

Table 4 compares internal communities with other forms of organizational structures (adapted from Wenger et. al., 2002). Formal organizational structures share one thing in common – they are established by and are accountable to management. Thus, management has an interest in gathering and using outputs from such structures to realize a return on their investment in the effort. Communities of practice are in a grey area, ranging from structured communities that approach, but do not attain, formality, through semi-structured and informal communities.

Table 4. Communities of Practice and Formal Organizational Structures (adapted from Wenger et.al, 2002).

Structure	Purpose	Membership	Common ground	Duration
Communities of Practice	create and share knowledge	self-selected or nominated	Passion, expertise, profession	evolve and end organically
Business units	deliver product or service	report to management	job requirements, common goals	permanent
Committees	address problems, opportunities	represent management	shared responsibility	ongoing
Task group	complete assigned task	assigned by management	goals and objectives	temporary, fixed term
Projects	accomplish project objectives	allocated by management	milestones and deliverables	until objectives are accomplished

Direct management interest in the output of communities ranges from supported (structured) through encouraged and promoted (semi-structured), to valued or ignored (informal). Structured communities typically have processes built into their charters that are designed to transform community outputs into authoritative knowledge (decisions and actions). Semi-structured and informal communities require pro-active processes to facilitate the transformation.

Community champions, sponsors, and leaders play a key role in transferring community knowledge. They ensure that community outputs of interest to the organization are brought to the attention of senior management, in ways that they relate to, accompanied by recommended actions. Ideally, a predetermined process should be embedded into the decision-making infrastructure to facilitate such transformations.

External communities and networks of interest to an organization almost invariably fall into the informal category from an organizational perspective. This may be a sidebar to someone's normal duties or time may be allocated for the activity, but in any case, the investment is typically minimal. One or a few employees provide a liaison or interface between the organization and such communities. Their first task is to bring external community developments of interest to the organization into the organization. These could take many forms, including: best practices, events or situations, recent developments, innovations, or lessons learned. Importing may well be done through an organizational community devoted to the subject or it could be done through normal environmental monitoring channels if such a community does not exist.

The next task is to do what internal communities do well – consider the input from the organization's perspective and transform it into a recommendation. Is it a valid idea? What business problem does it address? What are the costs and benefits? What are the risks? How will it work in our context? What has to be changed to adapt it? This is an ideal role for communities of practice, with their ability to quickly respond to emerging trends and issues. Once the analysis is complete, it should be moved into the authoritative hierarchy following processes described in section 4.4 (authorizing explicit knowledge).

There is some confusion between community and committee roles in transforming explicit knowledge into authoritative knowledge through recommendations, as evidenced by committees sometimes being established to review community recommendations and, in turn, recommend action. Although this transfers explicit knowledge into the authoritative decision-making regime, it is both redundant and unnecessary. If a community comprises subject-matter experts, little value is added by a formal committee review, especially if some of the committee members know less about an issue than most members of the community. Conversely, using a committee or work group to develop a plan to implement community recommendations is an effective way to harvest and structure explicit community knowledge.

4.4 Authorizing Explicit Knowledge

Transforming explicit knowledge into a funded organizational mandate is the single greatest challenge confronting KM. Yet, this process receives scant attention in the KM literature. Knowledge managers have the explicit knowledge; they know what needs to be done; case studies abound on how to do it; KM is known to yield a substantial return on the investment; and it is essential to organizational sustainability in the knowledge economy. Why then, has it proven

so difficult to accomplish and to sustain in government departments and agencies? Why has the shoal of authoritative approval caused so many KM initiatives to founder and disintegrate?

The process of transforming explicit knowledge into authoritative knowledge is well understood by bureaucrats who work in enterprise-level staff positions. They simply don't call it by this name; rather, they call it "getting something approved." Equally important, they are not strongly committed to or involved with any particular initiative. Their job satisfaction comes from having correctly followed the submission process, regardless of whether or not a submission is approved. They understand that "you win some and you lose some." In either case, they return the initiative to the specialists and move on to the next submission.

Knowledge managers tend to view the bureaucratic process with disdain. They see the "righteous path" so clearly, why doesn't everyone else? The reason is simple – executives see things through very different and much broader lenses than knowledge managers. To a knowledge manager, leading the way and enhancing organizational productivity are paramount; both enhance personal careers. To an executive, many considerations affect a decision in addition to technical merit, including competing resource requirements, organizational priorities, political realities, and personal values. Similarly, leading the way is a two-sided coin from an organizational perspective. It is admired and provides management limelight when successful. Conversely, it involves risk – an anathema to many bureaucrats.

This section is not intended as a primer for functioning in a bureaucracy; libraries of books and documents are available on the subject. It is intended to link KM to authoritative processes. Further, one size cannot fit all, as each organization has its own culture and business that provides the context for how to proceed. Rather this section reflects experience acquired through working in a number of government science-based departments and agencies. Finally, this section uses establishing and sustaining a KM initiative as an example, although the discussion would be equally applicable to any significant effort to transform explicit knowledge into an approved project or program.

Two aspects of transforming explicit knowledge into authoritative knowledge, in the form of actions, projects, and programs are described – establishing and sustaining an initiative.

4.4.1 Establishing an Initiative

KM faces a powerful chicken-and-egg dilemma. It is difficult for executives to understand without real examples and it is difficult to develop real examples without prior approval and funding. The only way around this dilemma may be to first "make it real" by developing a local project-scale initiative using resources that are available to a supportive manager. Then, the knowledge manager can demonstrate what KM means by developing useful tools that solve recognized business problems. Although this has a high probability of success at a project scale, due to the elimination of complex corporate issues, it has an important limitation. The bulk of the benefits to an organization are achieved at the enterprise level. As Saint-Onge and Wallace (2003) observe: "A knowledge initiative that's narrow in focus without enterprise-wide sponsorship and broad involvement of employees from across the organization, starts as a peripheral effort and will most likely end as a peripheral effort" (p. 15)

It is important to understand that different people perceive and understand things differently. Citing Gardner's (1999) multiple intelligences, (linguistic, mathematical, musical, visual, bodily, interpersonal, and intrapersonal), Chris Collison used multiple approaches to engage a group of senior managers in supporting a KM initiative: statistical surveys, creating graphic illustrations, discussing quotations from respected leaders, emotional appeals through children, and interacting with others.¹² This recognizes the need for different metaphors and analogies to convey meaning to different individuals. It is also a practical application of Pigeau's truth acceptance process.

Even though managers understand what is proposed, resistance to change is a powerful, natural human behavior that has been recognized for millennia. And, notwithstanding the knowledge manageability framework, KM is ultimately about change; deep, cultural change that affects the way an organization does business. Even though only a single step is proposed, most executives recognize that a thousand-mile journey is implied, even if not spoken. KM will neither begin nor sustain itself easily. At some point, it has to raise its head above the parapet, and address resistance to change issues. When a proposal involves substantial change, as in the case of KM, a separate but integrated change management process is strongly recommended.

Resistance to change takes many forms that are usually embedded in a decision maker's psychological knowledge. Spoken words may conceal as well as reveal what someone is really thinking. Correctly interpreting what is actually meant is important to establishing a KM initiative. Expressions of resistance can be grouped into five categories: understanding, experience, resource limitations, management concerns, and the submission itself.

Understanding: "I don't understand any of this; this is too complicated; I don't like this fuzzy stuff; this doesn't make any sense." Managers admire creativity, but they do not fund things they do not understand. **Solution:** Keep it simple. There should be only one message, with appropriate analogies and metaphors to enhance understanding. Although knowledge managers must understand the underlying complexity and be able to drill down to it, they should post the picture of the completed puzzle behind a door, to be referenced only within the conclave of those who understand it. Each executive will come to understand KM in a way that they can relate to. A single metaphor is unlikely to work for everyone.

Experience: "We tried this before and it didn't work; we're already doing this; this may have worked there, but it won't work here; we're different from those organizations." We are asking senior managers to abandon much of what worked to get them to where they are today because it is no longer valid; a hard sell, indeed! **Solution:** Do your homework. Brief every decision maker prior to the meeting. Solicit and rectify or negotiate any reasonable objections that they may have to the submission. However, compromise has a limit. The challenge, to which there is no magic answer, is to recognize when a significant compromise, or a series of small compromises, could cause the initiative to fail. In such cases, another approach will be needed. The knowledge manager should personally participate in all briefings to witness the nonverbal as well as verbal reactions. If the submission is good, the preparation is adequate, and the compromises are reasonable, one should expect a strong majority of approvals.

¹²Chris Collison, personal communication (Oct. 22, 2010)

Resources: “There is no money for this; what can you do without a budget? I’m facing an Access to Information lawsuit and have no time for this; we can’t take staff away from other work.” Middle managers will vigorously oppose any initiative that reduces their budget or increases their workload, regardless of overall organizational benefits. **Solution:** Pick low-hanging fruit. Start with low-cost, small-effort, small-workload, activities. These will demonstrate real benefits of KM and develop trust that the KM group knows what it is doing. Ultimately, the success of KM will depend on adequate funding at the enterprise level.

Management: “Exactly what will be delivered? When will this be finished? What, precisely, are the benefits? Will this save me money this year?” Managers prefer short-term, low-risk deliverables that can be measured or counted. **Solution:** Think big, but start small. Divide the initiative into low risk, short-term project-scale undertakings with concrete, measurable, high-return, early deliverables. Select projects that solve recognized business problems. This should be done in the context of an overall strategy that provides a place for initial project-scale developments.

Submission: “We need more detail; there is too much detail; the submission does not consider (our issue); this needs to be changed (in an endless cycle); I don’t believe you.” These (and many others) are red herrings, used in lieu of publicly stating the underlying reason for objecting to an initiative. **Solution:** Leadership is essential. Do not assume that lack of a negative response during pre-briefings indicates concurrence. If someone publicly voices a concern that was not expressed during the pre-briefings, or that has been expressed and adequately addressed, or that has little merit, it is essential that the senior manager or executive moves the initiative forward to avoid having it become trapped in an endless cycle of submissions.

4.4.2 Sustaining an Initiative

The second greatest challenge facing KM is sustaining an initiative over a long term within an ever-changing environment. In fact, experience in the Government of Canada has been one of repeated attempts to initiate KM, followed by decline and demise or becoming just a shadow of its initial promise.¹³ Some departments have made multiple attempts without being able to sustain an initiative.

To be sustainable, KM must reach a “critical mass.” It must become institutionalized in every aspect of an organization’s infrastructure – its governance, work processes, systems, and above all, its people at an individual, community, and cultural level. This takes 5 to 10 years; far more time than is normally available to government projects within the duration of a government or administration and the annual budget cycle. There are a number of issues related to sustaining long-term initiatives in a short-term environment: leadership, governance, reorganization, priorities, support, and culture.

Leadership change is an issue in the public sector. New leaders have a great mass of new material to absorb. Getting their attention, explaining the importance of KM, and securing their

¹³Paul McDowall, Canada School of Public Service, presentation to the Interdepartmental Knowledge Management Forum

support in the context of many departmental or sectoral priorities takes several months to a year. Once successful, the knowledge manager may have only a year or two before the next leadership change. Short-term deliverables must be scheduled within this time frame.

Governance plays an important role in transitions across leadership changes. Autocratic approaches to KM have resulted in impressive short-term accomplishments. However, immediately upon a leader's departure, departments generally revert back to previous feudal or functional silo patterns, often more deeply entrenched and better protected than previously. Representative, federated governance, despite the time-consuming and sometimes frustrating need for constant negotiation and consensus building is the only sustainable form of governance for KM.

Reorganization – Given the many places and levels into which KM can be and has been positioned in organizations, reorganizations can be highly disruptive. Each position has a particular perspective which may require a substantial, sometimes irreversible, shift from the previous direction of KM. Positioning KM within one or two steps of the executive committee helps to mitigate reorganization issues, as is generally done in international or national organizations. In government agencies, however, KM tends to be at least three or four levels removed from the executive level – a decided handicap. In such cases, it is important that KM be closely linked to an organization's business model rather than that of a sub group which may be subject to greater volatility.

Priorities – In the public sector, yesterday's priority is today's history. The world is constantly changing at an ever-increasing pace, and government priorities reflect the external environment. New leadership often brings new priorities. Priorities on paper can change much more rapidly than underlying initiatives that involve substantial commitments and momentum. As previously, the key is for KM to be closely aligned with an organization's business strategy, which tends to reflect long-term directions rather than short-term priorities.

Support – Long-term initiatives are often provided with sufficient resources to begin work, with the expectation that they will return to demonstrate initial success and request resources to continue the effort. This is a sound management technique that enables learning and evolving as an initiative gains experience. However, each return for continued funding represents a risk, given the possible external changes that may have occurred since the previous approval. It is important that initial outputs be delivered as and when promised. It is equally important that the initiative be prepared to adapt to a changed environment.

Culture – Becoming a knowledge organization is, ultimately, the only way to sustain KM. This requires a fundamental evolution to a knowledge culture. Culture is, perhaps, the most resistant to change of any aspect of an organization. In fact, culture change is so grand in scale, so sweeping in scope that attempting to implement it directly is unlikely to succeed. Rather, knowledge managers should address the many elements of the knowledge infrastructure that influence culture, such as rewarding desired behaviors, developing favorable knowledge policies, leveraging knowledge work, and implementing systems that help people do their work. As dripping water eventually wears away stone, each success, though individually limited, will

collectively move the culture, imperceptibly but assuredly, toward that of a knowledge organization.

5. Conclusions

The history of KM reveals difficulties associated with defining, and measuring knowledge as well as implementing knowledge management in the public sector. This chapter proposes a new paradigm – knowledge manageability – in which KM does not attempt to change an organization's culture, but rather adapts its principles and practices to the existing culture.

The manageability framework classifies knowledge and knowledge work according to its relative manageability rather than its underlying nature. Knowledge manageability incorporates elements of several existing organizational frameworks while using the Cynefin sense-making/classification framework as its core model. This framework describes four domains of knowledge and knowledge work: common, complicated, complex, and chaotic. Together, they describe and organize knowledge and knowledge work into cohesive groups with related properties that lend themselves to specific patterns of management activities. These patterns reflect different degrees to which knowledge and knowledge work can be managed.

Knowledge manageability is organized under four management regimes. Each regime is characterized according to what is managed, management objective, organizational interactions, and knowledge domain. The regimes are: authoritative hierarchy (decisions, control, authority, common), organizational structure (objects, coordination, enterprise, complicated), negotiated agreements (people, collaboration, partnerships, complex), and responsible autonomy (environment, participation, networks, chaotic).

Each management regime is characterized with terms that describe the purpose, key process, emphasis, operating model, motivation, interactions, sense-making domain, type of knowledge and business model. Across the four regimes, purpose ranges from control to self-organization; key processes range from authorizing to creating; emphasis ranges from concrete objectives to an enabling environment; and the operating model ranges from unification to diversification. The sense-making domain ranges from common to chaotic, the type of knowledge ranges from authoritative to innate, and motivation ranges from extrinsic to intrinsic.

There is a direct relationship between management regimes and knowledge characteristics. As manageability ranges from highly structured, authoritarian approaches to unstructured autonomous environments, knowledge ranges from highly structured and embedded into products and services to unstructured and innate in individuals. Conversely, as knowledge ranges from authoritative to innate, appropriate management regimes correspondingly range from authoritative control to responsible autonomy.

Knowledge is the lifeblood of an organization. Impede the flow of knowledge and an organization functions poorly, at best. Knowledge must flow across the four manageability regimes: from innate, to tacit, to explicit, to authoritative. Knowledge changes both its form and content as it flows from creation to application. The chapter concludes by describing methods of

eliciting innate knowledge, capturing tacit knowledge, harvesting community knowledge, and authorizing explicit knowledge.

The knowledge manageability framework encompasses a spectrum from dynamic, unstructured organizational environments to relatively inflexible, highly structured authoritative environments. It provides a robust, multi-dimensional framework for managing knowledge across diverse organizational contexts. By avoiding the need to change inherently structured culture and work processes, it greatly reduces the challenges associated with implementing knowledge management in public-sector organizations. We propose that it represents a significant and useful extension of existing approaches to managing organizational knowledge in any bureaucratic organization, whether in the public or private sector.

References

- Allee, Verna (2003) *The Future of Knowledge: Increasing Prosperity through Value Networks*, Butterworth-Heinemann Boston, MA. 294 p.
- Anklam, Patti (2007) *Net Work: A Practical Guide to Creating and Sustaining Networks*. Butterworth-Heinemann, Burlington, MA. 268 p.
- Buckman, Robert H. *Building a Knowledge-Driven Organization* (2004) McGraw-Hill, New York, NY, 264 p.
- Çambel, A. B. (1993) *Applied Chaos Theory: A Paradigm for Complexity*. Academic Press, Inc. Boston, MA. 246 p.
- Capra, Fritjof (1975) *The Tao of Physics : An Exploration of the Parallels between Modern Physics and Eastern Mysticism*. Shambhala Publications, Boston, MA 355 p.
- Carty, Matthew M. and Richard Lansford (2009) *Using an IT Business Value Program to Measure Benefits to the Enterprise*. Intel Corporation, White Paper, 15p. Retrieved from <http://download.intel.com/it/pdf/itbusinessvalue.pdf>
- Conner, Daryl R. (1998) *Leading at the Edge of Chaos*. John Wiley & Sons, Toronto, ON. 352 p.
- Dalkir, Kimitz (2005) *Knowledge Management in Theory and Practice*. Elsevier Butterworth-Heinemann Oxford, UK. 356 p.
- Dixon, Nancy (2010, October) *Actionable Strategies for Increasing Knowledge Sharing*. Pres. to: KM World 2009, San Jose, CA. Retrieved from http://conferences.infotoday.com/stats/documents/default.aspx?id=2990&lnk=http%3A%2F%2Fconferences.infotoday.com%2Fdocuments%2F67%2FA102_Dixon.ppt
- Dixon, Nancy (2010, October) *The Three Eras of Knowledge Management*. Retrieved from <http://www.nancydixonblog.com/>

Drucker, Peter F. (1993) *The Post-Capitalist Society*. Harper Business, New York, NY, 232 p.

Drucker, Peter F. (1999) *Management Challenges in the 21st Century*. Harper Collins, Inc. New York, NY.

Edvinson, Leif and Michael Malone (1996) *Intellectual Capital: Realizing Your Company's True Value by Finding Its Hidden Brainpower*. Harper Collins Publishers, New York, NY 225 p.

Elroy, Mark W. (2003) *The New Knowledge Management: Complexity, Learning, and Sustainable Innovation*. Butterworth Heinemann, New York, NY. 246 p.

Fairtlough, Gerard (2005) *The Three Ways of Getting Things Done*. Triarchy Press Publications UK. 110 pp.

Fencl, Wendy (2008) *10 Tips for Engaging Your Team*. Blessing White North America, Skillman, NJ 4p. Retrieved from <http://blessingwhite.com/content/articles/enews/july2008.asp?pid=2>

Florida, Richard (2002) *The Rise of the Creative Class: How it's Transforming Work, Leisure, Community and Everyday Life*. Basic Books, New York, NY. 404 p.

Gardner, Howard. (1993) *Multiple Intelligences: The Theory In Practice*. Basic Books, New York, NY. 304 p.

Hamming, Richard W. (1997) *How to Think about Trends*. In: *Beyond Calculation* (Denning and Metcalfe, 1997). Copernicus; Springer-Verlag, New York, NY.

Horibe, Frances (1999) *Managing Knowledge Workers*. John Wiley & Sons, Etobikoke, ON.

Kuhn, Thomas (1970) *The Structure of Scientific Revolutions*. Univ. of Chicago press, Chicago, IL. 174 p.

Kurtz, C.F. and David J. Snowden (2003) *The New Dynamics of Strategy: Sense-Making in a Complex and Complicated World*. IBM Systems Jour. 42(3)

Leonard, Dorothy (1995) *Wellsprings of Knowledge: Building and Sustaining the Source of Innovation*. Harvard Business School Press, Boston, MA. 334 p.

Lorenz, Edward N. (1963). *Deterministic Nonperiodic Flow*. Jour. Atmospheric Sciences **20** (2): 130–141. Retrieved from [http://dx.doi.org/10.1175/1520-0469\(1963\)020<0130:DNF>2.0.CO;2](http://dx.doi.org/10.1175/1520-0469(1963)020<0130:DNF>2.0.CO;2)

Machlup, Fritz (1984) *The Economics of Information and Human Capital*. Princeton Univ. Press, Princeton, NJ. 644 p.

Mandelbrot, Benoit (1983) *The Fractal Geometry of Nature*. W. H. Freeman and Co. New York, NY 458 p.

- Morgan, Gareth (1996) *Images of Organization*. Sage Publications, Beverly Hills, CA. 503 p.
- Nonaka, Ikujiro and Hirotaka Takeuchi (1995) *The Knowledge Creating Company: How Hapanese Companies Create the Dynamics of Innovation*. Oxford Univ. Press, Oxford, UK. 284 p.
- Nonaka, Ikujiro (1998) *The Knowledge-Creating Company*, Ch. 2 in: Harvard Business Review on Knowledge Management, Harvard Univ. Press, Boston, MA p. 21-46.
- O'Dell, Carla S. O'Dell and Jackson Grayson (1998) *If Only We Knew What We Know*. Free Press, New York, NY.
- Pigeau, R.A. (2004) *An Application of KM in a Research Domain*. Presented at the DRDC KM Forum in Ottawa, Canada, January 28, 2004
- Pigeau, R. A. (2004) *The Human Dimensions of Cyberspace*. Pres. to: DRDC Science & Technology Symposium on Computers Everywhere and in Everything, Ottawa, ON, April 21, 2004.
- Polanyi, Michel (1962) *Personal Knowledge: Towards a Post-critical Philosophy*. Univ. of Chicago Press, Chicago, IL. 428 p.
- Prigogine, Ilya (1984) *Order Out of Chaos: Man's New Dialogue with Nature*. Bantam Books, New York, NY. 349 p.
- Ross, Jeanne W., Weill, Peter, and David C. Robertson C. (2006) *Enterprise Architecture as a Strategy: Creating a Foundation for Business Execution*. Harvard Business School Press, Boston, MA.
- Rubenson, Kjell and Hans G. Schuetze (2000) *Transition to the Knowledge Society: Policies and Strategies for Individual Participation and Learning*. Univ. of British Columbia, Institute for European Studies, Vancouver BC. 463 p.
- Saint-Onge, Hubert and Charles Armstrong (2004) *The Conductive Organization: Building Beyond Sustainability*. Elsevier Butterworth Heinemann, Boston, MA, 249 p.
- Saint-Onge and Debra Wallace (2003) *Leveraging Communities of Practice for Strategic Advantage*. Butterworth-Heinman, Boston, MA. 370 p.
- Savage, Charles M. (1996) *5th Generation Management*. Elsevier Butterworth-Heinemann. Boston, MA. 341 p.
- Senge, Peter M., (1990) *The Fifth Discipline: The Art and Practice of the Learning Organization*. Currency / Doubleday, New York, NY. 423 p.

- Simard, Albert J. and Philippe Jourdeuil (2013) *Knowledge Services: A Synthesis of Best Practices*. Defence Research & Development Canada, Corporate Services, Knowledge and Information Management Directorate, Ottawa, ON. 226 p.
- Snowden, David (2007) The Origins of Cynefin. Cognitive Edge, 17p. Retrieved from www.cognitive-edge.com
- Stewart, Thomas A. (1997) *Intellectual Capital: The New Wealth of Organizations*. Bantam Doubleday Dell Group, New York, NY. 278 p.
- Stoyko, Peter (2010) Compliance, Motivation, and Engagement. *Fugitive Knowledge*. Retrieved from <http://www.stoyko.net/fugitiveknowledge/?p=1686>
- Taleb, Nassim N. (2007) *The Black Swan: The Impact of the Highly Improbable*. Random House, New York, NY. 366 p.
- Tapscott, Don and Anthony D. Williams (2006) *Wikinomics: How Mass Collaboration Changes Everything*. Portfolio/Penguin, New York, NY. 324 p.
- Tosti, Don and Fred Nickols (2010) *Making Players out of Spectators, Cynics, and Deadwood*. Distance Consulting LLC. 8p.
- Weill, Peter and Marianne Broadbent (1998) *Leveraging the New Infrastructure: How Market Leaders Capitalize on IT*. Harvard Business School Press, Boston, MA.
- Weill, Peter and Jeanne W. Ross (2004) *IT Governance: How Top Performers Manage IT Decision Rights for Superior Results*. Harvard Business School Press, Boston, MA.
- Weill, Peter and Jeanne W. Ross (2009) *IT Savvy: What Top Execs Need to Know to go from Pain to Gain*. Harvard Business School Press, Boston, MA.
- Wenger, Etienne, Richard McDermott, and William M. Snyder (2002) *Cultivating Communities of Practice*. Harvard Business School Press, Boston, MA. 284p.