Knowledge Management, Response Ability, and the Agile Enterprise

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Abstract

This paper defines the agile enterprise as one which is able to both manage and apply knowledge effectively, and suggests that value from either capability is impeded if they are not in balance. It looks at the application of knowledge as requiring a change, and overviews a body of analytical work on change proficiency in business systems and processes. It looks at knowledge management as a strategic portfolio management responsibility based on learning functionality, and shares knowledge and experience in organizational collaborative learning mechanisms. It introduces the concept of plug-compatible knowledge packaging as a means for increasing the velocity of knowledge diffusion and the likelihood of knowledge understood at the depth of insight. Finally, it reviews a knowledge portfolio management and collaborative knowledge development architecture used successfully in a sizable cross-industry informal-consortia activity, and suggests that it is a good model for a corporate university architecture.

Introduction

Knowledge management, organizational learning, collaboration, and the agile enterprise are all current concepts being explored by various groups of academics, consultants, and business managers. The general motivation for this interest is the observation that organizations are finding it more difficult to stay in synch with the pace of change in their operational and competitive environments. Though many of these explorations are still myopically focused on a single one of these issues, more and more are recognizing a convergence.

We will examine this convergence from the point of view that all of these concepts are strongly interrelated, and argue that organizational agility is achieved when knowledge management and change proficiency are balanced organizational competencies.

Our personal interest in knowledge management has come about through the back door - we were trying to understand how to design highly change proficient agile organizations. After an initial focus on systems engineering principles applied to the design of highly adaptable business practices and business processes we eventually came up against the fact that changing anything requires that somebody learn something, and that this learning process was every bit as big an obstacle as rigid inflexible system design. Since learning is the process that develops knowledge, moving our focus on to knowledge management was a natural step. From this new perspective hindsight showed that we had been heavily involved in the key issues of knowledge management all along - in our attempts to understand the agile enterprise we had employed and refined collaborative learning mechanisms that brought hundreds of similarly interested people together in this mutual quest.

We will explore these relationships and experiences here, and provide an overview of change proficiency as the mechanism necessary to act upon changing knowledge effectively.

We now believe that knowledge management and change proficiency are co-dependent relationships, and see them as the enabling competencies for an agile organization. And we view the current interest and need for both as caused by the accelerated pace of new knowledge development.

We view agility in organizations not as a goal or a strategy, but rather as a fundamental existence necessity. Organizations have always had to be sufficiently agile to adjust to their changing environment or cease to exist. The only reason agility is being discussed in recent years is because the environment is changing faster than it used to, and faster than most organizations are capable of matching. This is a new and unfamiliar business situation, and poses a threat to organizational viability.

Interestingly, this observation about agility not really being a new thing is similar to what many are beginning to say about knowledge management. In neither case is it that we are rediscovering something we forgot; but rather that the old mechanisms which have been there all the time are no longer adequate in the way they are being practiced.

We recognize the infancy of new knowledge development for both knowledge management and organizational change proficiency, and know that a lot of what we suspect today and even believe will mature and change in the coming years. Nevertheless, we will establish some working definitions of these still fluid concepts to facilitate the discussion.

Knowledge

This human thing we are distinguishes itself from other life by generating and applying knowledge. Our increasing population is building upon an increasing body of past knowledge - which increases the frequency of new knowledge generation and speeds the decay of old knowledge value - making the general business environment, which is built on knowledge, more unstable.

New knowledge demands to be applied. When one business applies new knowledge valuably, others have no choice but to follow, if they can.

Knowledge has no value until it is applied. When new knowledge is applied, it introduces a change into the environment, which generates a value. Change that comes from the application of new knowledge is called innovation when the value is positive. The relationships of knowledge, innovation, and application have been explored at length [Amidon, 1997].

Knowledge which cannot be applied has no value. Knowing about the canals on Mars is just as useless to an automotive assembly plant as knowing about a new assembly technology that cannot be implemented.

Agility

In 1991 I co-led an intense four-month-long collaborative workshop at Lehigh University that gave birth to the concept of agile enterprise [Dove, 1991]. This workshop was funded by the US government, and engaged fifteen representatives from a cross-section of US industry plus one person from government and four people as contributing facilitators. The Japanese had just rewritten the rules of competition with the introduction of lean manufacturing. Our intent was to identify the competitive focus that would be the successor to lean - believing that there would be value in building competency for the next wave rather than simply playing catch up on the last.

The group converged on the fact that each of their organizations were feeling increasingly whipsawed by more frequent change in their business environments. The evidence was everywhere that the pace of change was accelerating - and already outpacing the abilities of many established organizations. With even faster changes expected it became evident that survivors would be self-selected for their ability to keep up with continuous and unexpected change.

We dubbed this characteristic agility and loosely defined it as "the ability of an organization to thrive in a continuously changing, unpredictable business environment." Not unlike defining a dancer as one who dances.

Our thoughts at that time were that technology and globalism were the principle drivers of this changing environment. I have since come to know that it is more accurate to focus on the knowledge explosion as cause, and more useful to look at knowledge management as one of two key enablers for agility.

The other key enabler is change proficiency - a competency that allows an organization to apply knowledge effectively - whether it is knowledge of a market opportunity, a production process, a business practice, a product technology, a person's skills, a competitor's threat, whatever.

I now prefer to define agility succinctly as: *the ability to manage and apply knowledge effectively*. Of course this simple statement hides a lot of complexity, especially in the word *effectively*; but it offers more illumination than our earlier definition.

Agile is a word we associate with cats. When we refer to a cat as being agile we are observing that it is both physically adept at movement and also mentally adept at choosing useful movement appropriate for the situation. Agile carries with it the elements of timeliness and grace and purpose and benefit as well as nimbleness.

A cat that simply has the ability to move quickly, but moves inappropriately and to no gain might be called reactionary, spastic, or confused, but never agile. Picture a cat on a hot tin roof.

Conversely, a cat that knows what should be done but finds itself unable to move might be called afraid, catatonic, or paralyzed, but never agile. Like the cat that's got itself up a tree.

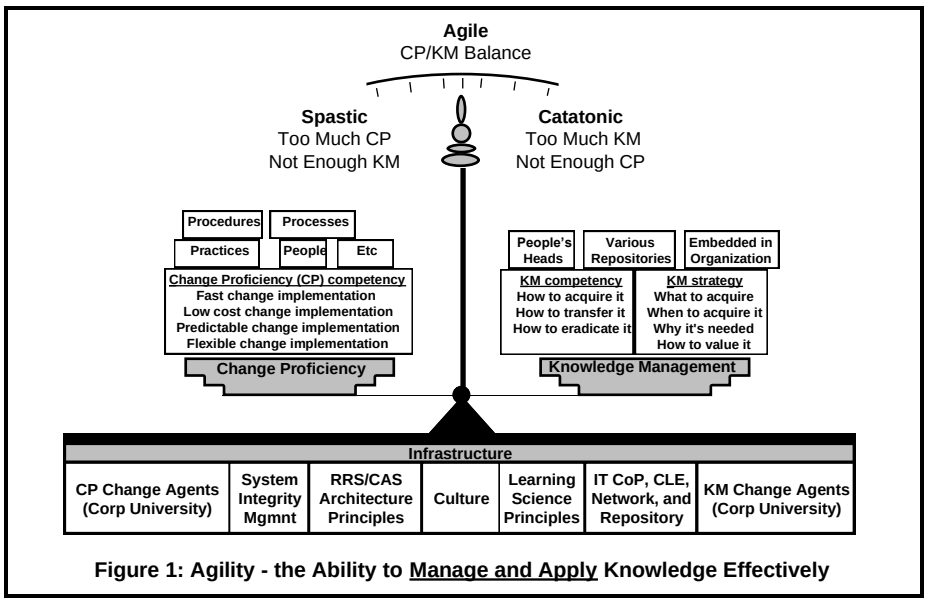


Figure 1: Agility - the Ability to Manage and Apply Knowledge Effectively

Up until that 1991 workshop my career was involved with start-up and turn-around management - where speed and urgency are important. First hand experience helped me appreciate the difference between developing a strategy and implementing it successfully. Knowing what to do was too often mismatched with the ability to do it. My engineering background started me looking for obstacles and solutions in the design aspect of organizational systems. Rather than go back to the entrepreneurial world I began a series of collaborative learning events with industry - seeking to understand what makes some business practices and process highly adaptable while most are extremely difficult to change.

Concurrently the concept of knowledge management and learning organizations were capturing increasing interest in other circles - for the same underlying reasons. Here we will consider organizational learning as a subset of knowledge management. In recent years our collaborative investigations have converged on the co-dependent relationships of change and learning [Dove, 1997-1998]. You cannot do one without the other. As to knowledge management - nothing happens unless and until somebody learns something.

The concepts of knowledge management and change proficiency are not new. Organizations throughout time have practiced both successfully or they have ceased to exist. What is new is the need for more formal and conscious understandings about these practices - raising them to the level of a recognized competency - brought about by the quickening pace of knowledge development and knowledge-value decay. What used to be done unconsciously and in its good old time is no longer adequate in competitive enterprise.

Balancing these two competencies is important.

A progressive auto assembly plant in Canada recently decided to abandon the traditional chain drive that moved all cars synchronously through the factory from work station to work station. They foresaw advantages in an asynchronous movement, and placed each car-in-process on its own automated guided vehicle (AGV), capable of independent movement and not in harness to the car in front. This promised more flexibility for adding mass customized features to individual cars without dragging all cars through stations where no work was performed. More importantly, If a workstation was shut down for any reason cars could be pool-buffered or rerouted to other

stations first and then return - while the rest of the factory continued to operate. Unfortunately when the plant went live the expected high throughput turned out considerable less then the traditional chain drive had provided. Under the old system a failed workstation shut down the entire production line and the silence was deafening - gaining immediate and total attention. With the highly fluid AGV flow, cars simply bypassed out-of-service stations and the comforting noise of industry continued. A classic architecture for increasing change-proficiency that resulted in a major failure because it was unmatched with the knowledge management issues. When I learned of this the immediate management reaction was to abandon the concept and return to the traditional method - I do not know if saner heads prevailed eventually.

At first look this shop-floor example may not appear to be associated with what we currently call knowledge management. Perhaps because we do not yet have a general theory of knowledge management. Nevertheless, this situation occurred because of a disproportionate focus on change proficiency without a balancing knowledge base of how and why to use it. Thus, we have a mismatch of both strategic knowledge as well as real-time operating knowledge.

As to a mismatched balance on the other side - revisit the classic story of Xerox and its Palo Alto Research Center. PARC was a collection of extremely innovative thinkers and learners, organized around active collaborative learning concepts [Bennis, 1997]. A very progressive knowledge management organization - yet unable to transfer its fruits into applied results within the Xerox family.

Figure 1 attempts to represent the key relationships and dynamics our investigations have reveled so far. Though both knowledge management and change proficiency are still immature practices, we feel a sufficient foundation exists to guide an organizational engineering project to success. Our remaining discussion here will attempt to show the integrated relationships among the elements depicted in Figure 1, and conclude with a suggested corporate knowledge management architecture.

Response Able Change Proficiency

All enterprises have frequent occasion to weather change, and each does so with its own degree of proficiency, or lack thereof. Some deal with each event as they come, some learn naturally from each event and get better at the next change, and some recognize competitive value in mastering the process of change.

We recognize change proficiency in both reactive and proactive modes. Reactive change is opportunistic, and responds to a situation that threatens viability. Proactive change is innovative, and responds to a possibility for leadership. An organization sufficiently proficient at reactive change to respond when prodded should use that competency proactively to put others off balance. Those that are good at reactive change yet poor at proactive change are exhibiting symptoms of poor knowledge management.

With collaborative workshop groups we have analyzed hundreds of business practices and process, as well as product designs, for high adaptability. It was evident early that there are subcategories or domains of change within both reactive and proactive categories. Initially we found it a useful tool in analysis work to consciously think of four different types of change in each category and ask how the system under analysis manifests each of them. Eventually we found a natural order among these types of change that reflects priority and mastery as proficiency is developed. This order is reflected in the change proficiency maturity framework shown in Figure 2.

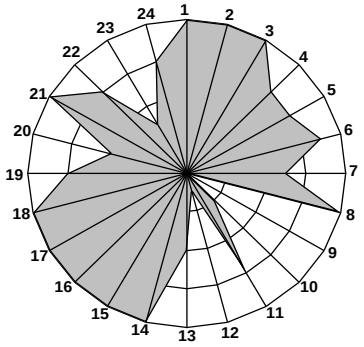
Proficiency carries with it the concept of betterness, which implies a metric. We were inclined in the early days to measure change proficiency in terms of speed, until we understood that change at any cost eventually breaks the bank. This then led us to consider other dimension of proficiency, which added to time and cost the dimensions of quality and scope. Change quality is basically predictability, i.e., the desired change occurs on time, on budget, on spec. Scope deals with the latitude of potential change, e.g., can you triple planned production when the mini-van market takes off unexpectedly, can you cut the production rate when the demand for Edsels doesn't materialize.

Scope is harder to measure absolutely than time, cost, and quality; but is nevertheless a very important and useful metric dimension. A Japanese car company was working toward a production capability for "any car, any plant, any time" as the ultimate answer for unpredictable demand needs. An American car company did a little analysis and decided that wild unpredictability was sufficiently accommodated when plants could make three cars and cars could be made in three plants.

These four metric dimensions were also found to have a natural order in priority and mastery as an organization became more proficient at change, and is reflected in the structure of the maturity framework.

Change Proficiency Maturity Model

Profile of 24 Business Practices.
Roadmap for Strategy and Improvement.



Maturity Stage	Working Knowledge	Metric Focus	Change Competencies Proactive	Change Competencies Reactive
0 Accidental	Examples	Pass/Fail	None	None
1 Repeatable	Concepts	Time	Creation	Correction
2 Defined	Metrics	Cost	Improvement	Variation
3 Managed	Responsibilities	Robustness	Migration	Expansion
4 Mastered	Principles	Scope	Modification	Reconfiguration

Maturity		Critical Business Practice
4.0	1	Strategic Plan Vision
4.0	2	Strategic Plan Dissemination
4.0	3	Strategic Plan Buy-In
3.0	4	Capital Investment Justification
3.0	5	Infrastructure Investment Justification
3.5	6	Business Eng. Investment Justification
2.5	7	Business Unit Relationships
4.0	8	Employee Relationships
0.0	9	Partner Relationships
1.0	10	Supplier Relationships
3.0	11	Customer Relationships
0.5	12	Information System Unit Relationships
2.0	13	Production Unit Relationships
4.0	14	Product Innovation Management
4.0	15	Process Innovation Management
4.0	16	Practice/Procedure Innovation Mgmnt
4.0	17	Vision/Strategy Innovation Mgmnt
4.0	18	Knowledge-Portfolio Strategy
3.0	19	Knowledge Generation
2.0	20	Knowledge Capture
4.0	21	Knowledge Mobilization
3.0	22	Leading Indicator Metrics
1.5	23	Operating Metrics
3.0	24	Health/Investment Value Metrics

Figure 2 : Change Proficiency Maturity Profile for Remmele Engineering, 1996

The five-stage maturity framework in Figure 2 is used to assess existing corporate competency at change proficiency, as well as to prioritize and guide improvement strategies. The framework progresses through five stages of working knowledge and strategic focus, with separate competency tracks for both proactive and reactive change proficiencies.

A *Change Proficiency Maturity Model* for an organization or even an entire industry can be built from this framework across a selected critical set of business practices. Figure 2 summarizes a maturity profile for Remmele Engineering, a $100 million machining company analyzed across 24 business practices [Dove, 1996]. Note that critical practices 18 - 21 are directly associated with knowledge management. Even knowledge management practices need to be change proficient.

The *Accidental* stage is characterized by the lack of any change-process knowledge, yet change manages to occur. The actual process is ad hoc: typically exhibiting false starts and retries, unpredictable completion dates and costs, surprising results and side effects, and undesirable reactions from, and effects on, the personnel involved. On the obvious bad side: grueling overtime, downsizing, multiple reengineering attempts, management fad-of-the-day, fire-fighting, and expediting.

The *Repeatable* stage is typically based on conceptual knowledge that is anecdotal and “lessons learned” from past change activities. Specialists and talented SWAT teams are recognized for prior successes and abilities to repeat these in relatively quick time frames.

The *Defined* stage begins to recognize formal change processes with documented procedures. The base of potentially successful practitioners is broadened as process rather than intuitive talent becomes appreciated. Metrics for the change process are identified and predictability becomes an elusive desire. Typically procedures at this stage are rigid and based on studied experience and analysis.

The *Managed* stage is characterized by the appointment of change managers (business engineers) with established responsibilities, though they may neither be called such nor recognized as such. An evolving knowledge base of change process fundamentals begins to emerge, appreciation for and participation in the corporate change-process is widespread, rigid procedures are loosened, and predictability is the norm.

The *Mastered* stage is characterized by a principle-based deep appreciation of adaptability, an understanding that process alone is not sufficient, and a conscious engineering and manipulation of the structures of business

practices and organizational infrastructures. Like a flock of birds swooping and turning as a unit, corporate change loses its event status and takes on a constant fluid motion.

The maturity model recognizes a sequential emphasis on specific competencies. Being able to take advantage of an opportunity while the opportunity is meaningful makes time the initial metric focus, even if a premium has to be paid. After the "cycle time" of instituting a change is sufficiently under control to hit the "market window", the cost of making these changes enters the spotlight. When both time and cost are acceptable the focus turns to predictability and consistency, or the quality of the change process. Finally, when good sound change proficiency capabilities are understood and managed an organization gains competitive advantage by broadening the range of application.

Some level of competency in the change domains of stages 1 and 2 are required of virtually all companies today. On the proactive side, *creation* (e.g., product realization) and *improvement* (e.g., cost reduction) are change capabilities that are at the very focus of today's competitiveness. Likewise on the reactive side, *correction* (e.g., fixing/replacing broken resources) and *variation* (e.g., accommodating customer preferences) are equally at the entry-level for playing today's game.

The more advanced stages 3 and 4 are where preemptive competitive capabilities emerge. On the proactive side *migration* competency prepares an organization in advance to weather major transitions as non-events, while *modification* competency ensures that unique capabilities can be added and eliminated with relative ease. On the reactive side, *expansion* competency handles opportunities like production-rate doubling or necessities like staff reductions as painless events, while *reconfiguration* competency reassembles existing resources into new productive configurations easily. These more advanced stages generally require an underlying purposeful design rather than a mere diligent honing of skills.

Analyzing highly adaptable systems for the underlying design principles has revealed a set of ten that are generally employed [Dove, 1998]. These RRS (Reusable, Reconfigurable, Scalable) principles are briefly outlined in Table 1. Examining them in any detail is beyond the scope of this paper. Here it is sufficient to know that purposeful design can ensure high change proficiency - or *response ability* as I like to think of it.

Table 1: RRS System Principles (Reusable, Reconfigurable, Scalable)

Any group of interacting units is a system: a team of people, an enterprise of divisions, a cell of workstations, a contract of clauses, a network of suppliers.

1. Self Contained Units: System of separable, self-sufficient units not intimately integrated. Internal workings unimportant externally.
2. Plug Compatibility: System units share common interaction and interface standards, and are easily inserted or removed.
3. Facilitated Re-Use: Unit inventory management, modification tools, and designated maintenance responsibilities.
4. Non-Hierarchical Interaction: Non-hierarchical direct negotiation, communication, and interaction among system units.
5. Deferred Commitment: Relationships are transient when possible; fixed binding is postponed until immediately necessary.
6. Distributed Control & Information: Units respond to objectives; decisions made at point of knowledge; data retained locally but accessible globally.
7. Self Organizing Relationships: Dynamic unit alliances and scheduling; open bidding; and other self-adapting behaviors.
8. Flexible Capacity: Unrestricted unit populations that allow large increases and decreases in total unit population.
9. Unit Redundancy: Duplicate unit types or capabilities to provide capacity fluctuation options and fault tolerance.
10. Evolving Standards: Evolving, open system framework capable of accommodating legacy, common, and completely new units.

Knowledge Management

In the agile organization knowledge management is responsible for having the right knowledge in the right place at the right time. Some of the issues faced by this responsibility are listed in Table 2.

Having knowledge at the right time means it is available sufficiently in advance of when it must be utilized to allow for the application time. If it is to be applied in an area that is difficult to change then it must be available early enough to allow for sluggish application. Unfortunately an idea who's time has come generally has many lovers - speed of implementation is at least as important as speed of knowledge acquisition.

Having knowledge at the right place means having it in a specific someone's head, not in the wrong

person's head and not in an on line repository or a corporate library or a document file. Technology is useful to help people find resources that can help them learn the knowledge they require; but it is neither a substitute nor an alternative for somebody learning something. The knowledge management responsibility includes both a push and a pull side. Knowing who has knowledge is no more important than knowing who needs knowledge - especially in these early times when corporate cultures are not yet naturally collaborative and knowledge seeking.

Table 2: Some Key Knowledge Management Issues

- What's new and necessary to know changes quickly.
- The value of what is already known changes quickly.
- Some of what is known is obsolete and toxic.
- Applying someone else's knowledge often has no glory.
- Knowledge is often not in the heads of the people who need it.
- Knowledge is understanding & appreciation, not data & procedure.
- Knowledge is learned, and there's no time-out for learning.
- Different people learn differently.
- Collaborative learning is best, but (usually) culturally unnatural.
- Knowledge is not naturally mobile within an organization.
- Large organizations are culturally diverse.
- Large organizations are geographically dispersed.
- KM and collaborative web tools are in their infancy.
- What to know and when to know it is a vital strategic issue.

Having the right knowledge means managing the organizational knowledge portfolio to anticipate emerging needs, satisfy current needs, and weed out the obsolete needs - everywhere in the organization. I prefer using the phrase *knowledge portfolio management to knowledge management* because it conveys this strategic distinction and separates itself from the territory staked out by information technology departments and vendors. That the CIO is confused about owning the CKO responsibility is a measure of how urgently this distinction needs to be made.

In late 1998 I had an opportunity to join a team assisting a multi-cultural global corporation define its knowledge management strategy and architecture. In preparation I searched for taxonomies and frameworks that might offer a working structure for us. Though I found many useful discussions of the issues and elements of knowledge management IT systems and knowledge management practices, it was evident that the field is young, still struggling for definition, and still looking for a place of natural ownership within the corporation. For wisdom without prescriptive direction, at least if you can turn a deaf ear to the obvious Lotus Notes bias, *Working Knowledge* by Davenport and Prusak offers a good working perspective for appreciating many of the major issues [Davenport, 1998].

In this search, only two formal efforts stood out - one with substance and one with promise. The work by Holsapple and Joshi at the University of Kentucky is useful for its generic structural approach that stops short of arguable prescriptive methodology, and is a multi-stage delphi-study-like amalgamation of the thoughts and views of some 30 plus practitioners in the field [Holsapple, 1998]. It offers a pure and simple structure that should be a useful armature for any organization looking for an uncomplicated start. Then there is the Knowledge Management Consortium (KMC) that is developing an aggressive and comprehensive model with the intent to submit it for ANSI/ISO standardization in late January 1999 [KMC, 1998]. Though details of this multi-level model are not available at this writing, a published outline and discussion with Ed Swanstrom, KMC executive director, promise a computational grounding in complex adaptive systems theory and math, and a strong attention to human, economic, and system engineering factors. I question the value and motivation of ANSI/ISO standardization at this time; but look forward to a model with this breadth and formalism, at least as a comprehensive strawman.

Perhaps there will never be a generally accepted definition, structure, and organizational home for knowledge management. With its promise to play a central and deciding role in competitive differentiation, these questions may be best answered differently by different firms leveraging their own unique strengths and missions. From my experience, effective knowledge management in a major consulting organization with its high churn of MBA advisors bears little useful resemblance to what is needed in a manufacturing organization. At some generic level, however, there should emerge some useful theory and process.

In the agile organization knowledge management is first about learning, second about application, third about purpose, and there is no fourth. These are ordered as prerequisites - it is of no use to have purpose if it cannot be enacted, and it is of no use to be action capable if people cannot understand the purpose and the means. Conversely, prerequisite skills can and do provide benefit even without or before the development of successor

skills. In Table 3 *purpose* is represented by *Requires* and *Identification*, and *learning* is represented by *Acquisition*, *Diffusion*, and *Renewal*. *Application* is not represented in that table as it is about *change proficiency,* which is a separate but co-dependant competency.

Table 3: Knowledge *Portfolio* Management

Important Distinction:
Portfolio puts strategic emphasis on the dynamics of knowledge value.

Working Definition: *The identification, acquisition, diffusion, and renewal of all knowledge that the organization requires.*

- ***Requires*** is a key word. It assumes a timely evaluation of what knowledge is needed when and by whom to meet operational needs and strategic objectives.
- ***Renewal*** recognizes that knowledge value degrades with time and can become toxically negative.
- ***Diffusion*** recognizes that knowledge is understanding, that this occurs in peoples heads, and that it involves learning.
- ***Acquisition*** recognizes that knowledge may be captured from internal resources, obtained from outside resources, or created by the organization.
- ***Identification*** recognizes the dynamic nature of knowledge value and seeks to anticipate new needs in time to acquire knowledge and diffuse it.

Learning

Knowledge management is first and foremost about learning - what should be learned, when should it be learned, and who should be learning it. How these things are done, of course, is where the *management* part comes in. You can call it knowledge identification, knowledge acquisition, knowledge diffusion, knowledge renewal or anything else you like - in all cases it boils down to somebody learning something. And that's the rub - partly because learning is generally misunderstood as teaching, and partly because it's a squishy human thing that lacks the cold hard edge of black and white decision making and technology selection.

Carla Hannaford, a neurophysiologist and educator, believes that all people start out as natural born learning machines. Many, however, get their works gummed up in early-life educational activities mismatched to their individual learning styles, and close that part of their minds - often forever [Hanaford, 1995].

Hannaford explains the neurophysiology of learning as: “Evolving [neuron] patterns become base reference points to understand new information....We continue to elaborate and modify the patterning throughout our lives. The base patterns, 90% of which are acquired in the first five years of life, give us the template on which to attach all future learning.”

Learning and innovation are very closely intertwined. "A man becomes creative, whether he is an artist or a scientist, when he finds a new unity in the variety of nature. He does so by finding a likeness between things which were not thought alike before, and this gives him a sense both of richness and of understanding. The creative mind is a mind that looks for unexpected likeness." [Bronowski, 1958].

Bronowski and Hannaford both place heavy weight upon the human brain’s reliance on metaphor, analogy, and simile as a (if not the) principle learning and creative mechanism. New knowledge is both created and assimilated naturally when it shares some common pattern with old knowledge.

The very knowledge explosion that is creating the need for knowledge management and change proficiency is also creating the means to respond. Biology, psychology, and cognitive sciences are generating knowledge about how the human brain learns; and have shown us that we can use this knowledge to intervene effectively in the learning process of virtually any and all humans [Various, 1998]. At the same time, technology is bringing us new concepts of distance learning, new access to the world’s storehouse of knowledge, and new interpersonal and group communication capabilities.

Educators for some time have understood that traditional teaching techniques do not succeed in creating learned and learning individuals from most who enter traditional educational institutions - either in the K-12 or University systems. It was common in the past to pass this off as the population’s bell-shaped intelligence curve, or in many cases, considered a useful fact to be used as an early weeding-out process of students that teachers should not waste time with. Today most educators are aware that different people learn differently, that there are multiple intelligence types, and that the brain is a natural learning organ whose functional mechanisms we are beginning to

Table 4: Some Brain Compatible Learning Leverage

Learning

- Accelerated when learner sees a solution to a known problem.
- Appreciated when learner discovers the solution.
- Applied when learner owns the solution.

Collaborative Learning

- Different people think differently.
- Different people see different things as important.
- Different people know different things.
- People know more collectively than individually.
- Collective discovery builds comprehensive knowledge.
- Collective discovery builds diffused ownership.
- Collective discovery can build knowledge at depth of insight.

Result: Better - Faster - More Mobile Knowledge

understand. Employment of emerging brain-based learning models is beginning to show irrefutable results. Though these new ideas are uncomfortable for the entrenched traditionalists, the results can not be denied.

Teaching is a push perspective, learning is a pull perspective. Creating and nurturing an environment for student-directed learning takes advantage of the student who has a driving curiosity or even a deep-felt need to learn something - a specific something. In collaborative learning workshops we have conducted over the last twelve years with industry participants we screen potential workshop subjects for real appeal to real people - and then require that participants have a real application for the results. Workshop participants self-select, bring passionate questions and diverse perspectives, and never fall asleep. This type of collaborative work is aided when subjects do not have a clear established knowledge base, and when no one can claim dominant expertise.

We have used these collaborative learning workshops to create new knowledge in the area of change proficiency and agile enterprise, to design new business practices and production processes, to analyze existing business practices and processes, to create insightful understanding of change proficient business systems, to establish and evolve research and knowledge portfolio agendas, and even to establish collaborative product-development project teams, requirements, and definitions. The majority of these collaborative learning projects were populated by people from different organizations with different agendas, but a common interest in learning something specific. The process we employ has evolved over the years, is called *Realsearch*, and has purposeful objectives, tools, and techniques for creating knowledge at the depth of insight and knowledge that can be readily diffused outside of the creating group [Dove, 1998]. Table 5 highlights the *Realsearch* approach. The interested reader will find strategic and structural concepts and application experience discussed in the previous reference. A detailed description of the workshop process and tools applied to the design of a collaborative learning knowledge management process appropriate for a corporate university can be found in essays 36 -41 in [Dove, 1996-1998], with companion knowledge diffusion examples in essays 33 - 35.

Realsearch is appropriate for collaborative learning *projects* - where a specific body of knowledge must be captured or created and then packaged as explicit knowledge for application and diffusion. Though the formal workshop core is described as a three-day event, the actual process may involve a sequence of workshops and require more time when formal and comprehensive explicit knowledge must be packaged for application and diffusion.

Realsearch workshops are an appropriate vehicle for implementing a knowledge portfolio strategy driven by a portfolio management group, as well as for solving focused problems or pursuing specific opportunities

Table 5: *Realsearch* Is ...

… a collaborative knowledge development and diffusion process which employs **real people** addressing **real problems** in **real time** - typically in mixed workshop groups.

It is an issue-focused, principle-based methodology that first defines the nature of a problem before considering solutions.

Solutions are then analyzed or designed according to a set of fundamental design principles.

Insight is fostered with this cause-and-effect understanding, and communicated within an organization by structured packaging matched to a local metaphor model -

which depicts this cause-and-effect relationship in story and graphic for a known and respected local business practice.

Because There is No *Time-Out* for Learning Anymore

manifested in multiple locations, both within and across normal *community-of-practice* boundaries.

Communities of practice (CoP), defined as "people bound by informal relationships who share a common practice," are another very important collaborative learning mechanism; and one which is receiving a lot of formal research and practice attention [Snyder, 1997]. Brown and Duguid distinguish communities of practice from organized task force and team structures: "The communities that we discern are, by contrast, often noncanonical and not recognized by the organization. They are more fluid and interpenetrative than bounded, often crossing the restrictive boundaries of the organization to incorporate people from outside [Brown, 1991]." A community of practice emerges when people with similar interests seek each other for discourse, experience sharing, and problem solving assistance. This is self-motivated continuous learning that has always been present to some degree in the work place, but now gets major leverage from the corporate intranet and even more from the knows-no-bounds Internet.

Participation in an active community is not without obligation. As to direct "can you help me" appeals, cultivating a network of people that you can seek direct advice from is a two way street. One Bell Labs employee called it "trading in knowledge," and recognized his obligation to possess knowledge of use to others in return for the privilege of seeking another's knowledge [Kelly, 1993]. This study at Bell Labs showed that among engineers a higher IQ did not correlate with higher productivity, initiative and networks counted the most - networks composed of people who cultivated respect so they could trade knowledge.

Active communities also learn through indirect conversation and invest in trust building. In the bottom-line industrial environment work-hour socializing, war story telling, and water cooler chat is not typically respected as producing value - in whatever form it occurs. Many places restrict access to the Internet and even the Intranet within the organization outside of management and certain *knowledge worker* positions. In the absence of a corporate culture or organizational encouragement for collaborative learning these mechanisms are sometimes abused. But the real work environment has always been based on collaborative learning, even when it is discouraged [Brown, 1991].

Collaborative learning mechanisms in Table 6 are at work in both organized *Realsearch* learning projects and in informal communities of practice [Dillenbourg, 1995]. People learn faster and better, and are less likely to repeat the mistakes of the past. British Petroleum nurtures a culture of collaboration and provides infrastructure support for communities of practice; and claims direct dollar values in the tens of millions of dollars from accelerated organizational learning and a reduction in repeated mistakes [Prokesch, 1997]. To dismiss their benefit as unique to the nature of their business is to misunderstand that they have simply built a collaborative learning environment matched to their situation. Another business with a different situation needs to design the supporting infrastructure appropriately, and not duplicate BP's. The *Realsearch* process is well suited to such designs as it focuses on defining the nature of the problem before considering solutions, and then crafts a change-proficient solution that both addresses the immediate requirements and evolves as the environment matures and changes.

Table 6: Collaborative Learning Mechanisms

Disagreement	Others will challenge concepts and conclusions individuals take for granted.
Alternative	Others will offer alternate concepts and conclusions to individual perceptions.
Explanation	Externalizing internal thought transforms tacit knowledge into explicit knowledge.
Internalization	Participative dialog conveys concepts that integrate with internal knowledge.
Appropriation	How one's concepts are adopted by others puts the concepts in new perspective.
Shared load	Multiple levels of thought are explored and integrated simultaneously.
Regulation	Consistency is monitored and discussed from multiple view points.
Synchronicity	People tend to help each other achieve a mutual level of understanding.

Adapted from [Dillenbourg 1995], with apologies.
See www.parshift.com, essay 47

Information technology has an important support and enablement role to play in collaborative learning - both for networked communities of practice and for remote-participation collaborative learning workshops such as *Realsearch*. There is sufficient off-the-shelf support for communities of practice already in various forms such as Lotus Notes, Microsoft's NetMeeting, and Ventana's Group Systems. British Petroleum has perhaps gone the

furthest at this point with an integrated technology and cultural program that makes good use of video and community trust building.

As to IT support for collaborative project workshops, sufficient technology may exist for a collaborative learning environment (CLE), but appropriate usage methodology has not yet been demonstrated. Most distance learning efforts to date demonstrate little more than a reproduction of class-room teaching and training (not learning) methods. Face-to-face *Realsearch* workshop success at insight development does not translate into the remote environment without considerable change - though not in its underlying principles. For instance, workshops must be spread over time rather than concentrated into three-day events; remote participants should come in pairs, at least, to permit local reinforcement; facilitation requires more coordination planning and management, and more one-on-one interaction; and unique attention must be focused on group-trust building. Though yet to be tested and evolved, remote *Realsearch* has the potential to produce even better results than face-to-face workshops - the intensity of a three-day face-to-face workshop necessitated by travel economics is not really compatible with the incremental neuronal learning growth dictated by our biological processes. Learning takes time to sink in.

In any event, requirements of technology intended for collaborative learning support should be specified by people responsible for the effectiveness of learning, and not by people involved in the creation and maintenance of a technology infrastructure - the two have different competencies, objectives and performance metrics.

Knowledge Packaged for Diffusion

Ever read one of those science fiction books where people have electronic sockets behind their ears? When you want to see a movie you plug in a chip. When you want to be an expert in something you plug in a different chip.

Cognitive science tells us that we assimilate new concepts only if they are within a small reach of what we already know - within the zone of proximity, as they say. This is why it takes so long to learn a new subject - we have to do the learning one step at a time, and each step has to sink in before the next can be built upon it.

When robotics were first introduced into the factory environment re-training electrical service technicians to the level of competency took a long time - and many never made it because the new concepts of soft instructions and programming logic were just too far from past experience. Those that did found learning new robot models and new brands of robots successively easier. Like the difference between learning to drive your first car and then moving on to the second and third.

Though the brain can parallel process many input channels, learning appears to be a sequential biological growth process. One way to speed up the learning process is to use multiple channels effectively. *Accelerated learning* is a body of educational technique that mixes verbal story telling and reading, graphics and visual stimulation, sounds and rhythm, movement and physical experiment, and other forms of input while teaching a student new material - and significantly speeds up the learning process in both adults and children [Jensen, 1996].

It isn't just parallel input at work here, but also the concepts of *multiple intelligences* and different *learning styles*. We are not, for instance, all adept at learning by reading, or by listening to a lecture; nor can all of us follow a global top-down explanation equally as well as a piece-by-piece bottom-up presentation.

In a sense, these accelerated learning techniques employ a shotgun approach, bombarding the student with multiple inputs - at least one is bound to be compatible with the student's learning style. In reality, many will be compatible to different degrees - since most of us are a mixture of all learning styles - some more predominant than others. And further, it appears that complex interactions among multiple channels promote and enhance learning to an even greater degree. In a sense, this approach presents information in a form compatible with the way the brain processes information into knowledge.

Plug computability allows us to hook any brand-name speaker up to a Fisher stereo system, put any producer's light bulb into the living room lamp, and read *almost* any email on our computer regardless of where it came from. These three cases work because they share a common standard for both physical and signal characteristics.

The science fiction knowledge chip is a fantasy example that goes one step further - it is "meaning" compatible as well as physical and signal compatible. The chip transfers instantly usable understanding. Think of an American product development manager receiving a Chinese-language email message explaining a product innovation methodology rooted in the Taoist teachings of Lao-Tse - and it was translated perfectly, did not convey any thoughts that were culturally unique, and was similar enough to prior knowledge to make total sense.

A respected theory is that cognition is shaped by culture in general and language in particular. Think about it - and you'll think in words - and only those that your socio-cultural background gives meaning to. Add to this the proximal-zone concept - that knowledge is assimilated in small steps. Now think about a culturally diverse, or even global, corporation - and its need to speed up the acquisition and mobilization of knowledge.

An organization won't try to solve this problem by eliminating cultural diversity - that would impair the important innovation potential. Language has some possibilities for standardization, though: some global companies, the recently merged Daimler-Chrysler for instance, are adopting English as the corporate language - though it may be quite awhile before production workers in Southern California can effectively communicate new methods to their counterparts in Detroit, let alone Stuttgart. As to everybody knowing almost what they have to learn next, not likely in a world that throws out surprises fairly regularly.

But what if we could take anyone in the flavor they came in - then mix in an additional common culture, an additional common language, and a new single knowledge pattern so universal that everything else they had to learn was only a small step away? Put like that it sounds as far-fetched as the knowledge-chip fantasy; but bear with me as I move from the slightly exaggerated to the demonstrably possible.

Our objective is a way to package a piece of knowledge so that it can be quickly and effectively transferred from one person to another within an organization. Our method will utilize concepts of language, culture, and pattern proximity. Basically we adopt a plug compatible standard that will require some learning time, but not much, from everyone in the group - and once learned, streamlines the knowledge transfer process.

Mechanisms we have tested in *Realsearch* appear to satisfy this promise. I'm referring to a knowledge template I've called a local metaphor model, a cultural context of change proficiency, and a language of change issues and Reusable-Reconfigurable-Scalable principles structured for systems thinking and communicated simultaneously in textual explanation, bulleted synopsis, graphic depiction, and connected story example (Figures 3 and 4).

This packaging example presupposes that the knowledge we want to transfer addresses some real problem, and that the real problem can be adequately described in terms of the dynamics of change that it presents. We believe that most knowledge of interest to business organizations fits these presuppositions, or can be made to; but we will save further elaboration for another time.

Let's look at the language part. We're not talking about a primary language as rich as the one we all use for thinking and communicating about everything, whether that be English or Chinese, but rather the concept of language as vocabulary and communication structure. Think of it as the plug compatible physical package that allows us to transfer data from one person to another. Like any language it will take some

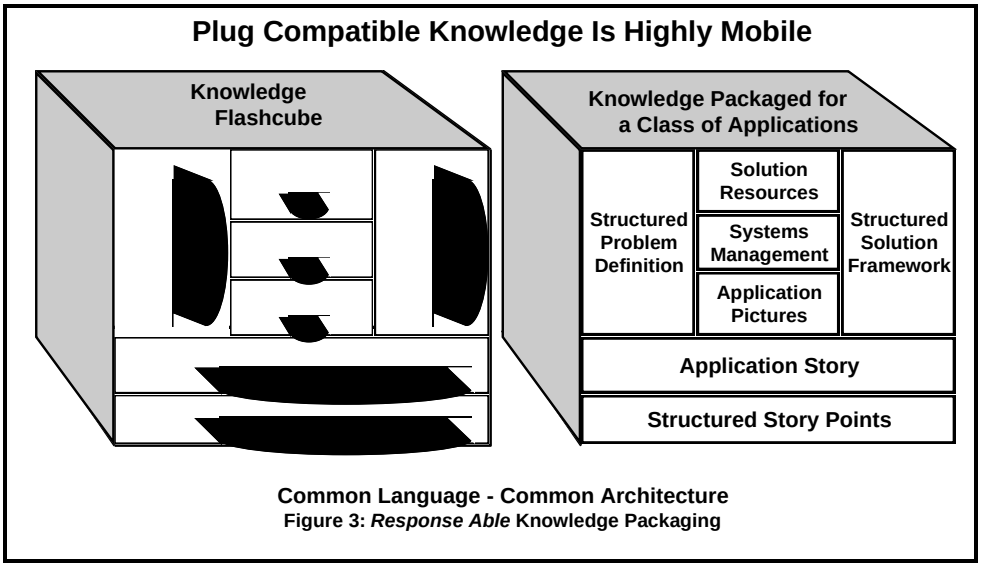


Figure 3: *Response Able* Knowledge Packaging

time to master, but not a great deal of time as the concepts we wish to express in this language are very limited.

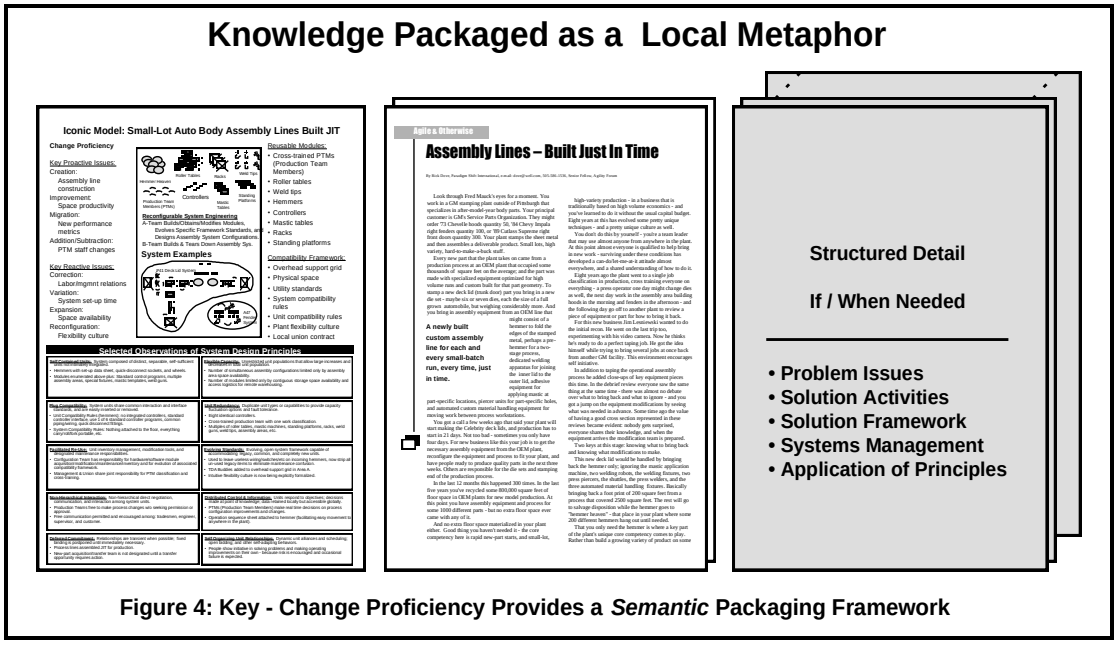


Figure 4: Key - Change Proficiency Provides a *Semantic* Packaging Framework

As to culture, we all have many already. There is the primary and greater societal culture we belong to as well as the usually-secondary work environment culture we belong to; and maybe the sub-cultures of the soccer team we play with on Saturday, the church group we meet with frequently, and the hunting lodge we visit in the fall. One may well be a subset of another but there are plenty of cases where seemingly contradictory cultures are embraced by the same person - like the religious physicist or the veterinarian hunter. The point is, we are all capable of embracing another culture. In this case we use culture as a set of values and beliefs that give context and perspective. Think of this common culture as providing our signal compatibility, giving us a means to transfer information, something beyond transferring mere data.

Finally we come to the transfer of knowledge. Mainly we need a pattern of new knowledge that looks fairly close to old knowledge so that the knowledge receiver has ready-made hooks for attaching new information. Say you want to educate your design engineers on effective ways to gain value from direct customer interaction - something foreign to them. Help them build a local metaphor model packaged in the knowledge transfer format first - perhaps modeling the departmental new-hire interviewing process that they know and respect Then introduce the new knowledge packaged in the same manner - assimilation is much easier because the general concept hooks are all the same. And with the language and culture of change proficiency, one local metaphor model is all that's needed, no matter how many more and different new procedures, processes, and practices will come their way.

Importantly, knowledge is packaged as a solution mechanism and not simply as a specific solution. Specific examples of solutions are provided as guidance. The knowledge is not packaged as a recipe for solving a single problem, but rather as a process for solving a class of problems in a changing environment.

This concept of plug-compatible knowledge packaging is explained in more detail starting with essay #49 at www.parshift.com, with specific examples in essays 33 - 35 that show the fine print in Figure 4.

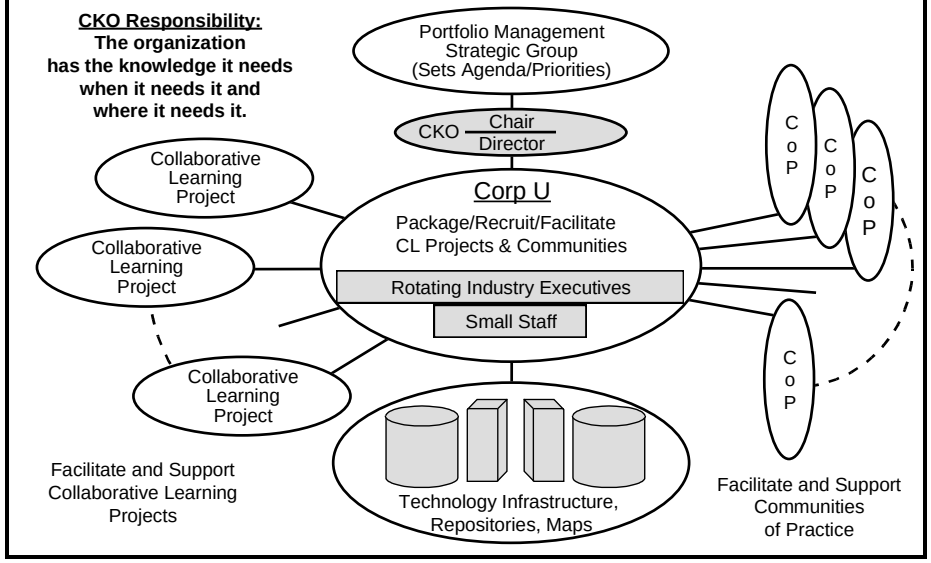
Purpose and Portfolio Management

Knowledge management is a tool to support an organization's strategic plan. This is its purpose. Unfortunately many organizations do not have a strategic plan sufficiently articulated, or one that spans an appropriate time period, to serve as the sole guiding source document for the person or group charged with strategic management of the knowledge portfolio. Corporate vision and mission must also be taken into account when anticipating what knowledge will be needed for the future.

Figure 5 depicts an architecture we installed at the Agility Forum in 1994 to create and manage a knowledge development agenda. The Agility Forum was organized after the 1991 collaborative project identified enterprise agility as a new and necessary competency for both competitive viability and competitive leadership. That project identified a problem. The Agility Forum was dedicated to finding solutions - and was formed spontaneously by

many of the project participant companies in partnership with Lehigh University. The US government through DARPA and NSF contributed significant funds beginning in 1994, which provided staff resources and an opportunity to organize purposefully.

Figure 5: A Corporate University Architecture



Immediately we created a group called the Strategic Analysis Working Group (SAWG). Its purpose was to identify an agenda of critical knowledge development necessary for understanding agility in organizations. Group composition was designed to represent various industries, various labor unions, the academic community, government, and influential organizations such as the National Center for Manufacturing Sciences. People were sought for their understandings of issues, their real interest/use/need for an agility knowledge base, and their ability to influence the communities they represented. The group met in two-day workshops approximately every six weeks. After a preliminary agenda outline was developed the meeting place was changed each time to include additional participants appropriate for specific agenda themes. For instance AT&T was the venue for the focus on Agile People issues, MIT and Harvard were combined to help flesh out the agenda for Agile Business Practices, UC Berkeley and Stanford were combined for Agile Virtual Enterprise, the Society of Manufacturing Engineers in Detroit helped flesh out the agenda for Agile Operations. The host provided meeting facilities and participants, and others in the local and national community appropriate for the subject were invited as well.

This strategic group was also responsible for establishing the organizational architecture of the collaborative learning groups that would implement the agenda, and finding and installing the facilitating chairs. Chairs were appointed for one-year terms and chosen for their interest in the subject, their objectivity, and their group facilitation skills. Chairs, with the assistance of staff, recruited people from the community at large with interests in the group's general area. The first meeting established individual personal interests and developed an agenda for the year, with specific knowledge deliverables. Groups then met in 2-day workshops approximately every six weeks at different locations chosen for their ability to demonstrate or shed light on a group's knowledge quests. These groups were the early development ground for the *Realsearch* process.

An annual conference provided a showcase for all new knowledge developed during the year and offered an opportunity for people and companies with broad interests to get a comprehensive overview.

I functioned as both the initial chair of the strategic group and director of the knowledge development groups - providing the linkage between strategy and implementation. Though my position was called director of strategic analysis, it is a model for chief knowledge officer. This architecture appears quite appropriate for a knowledge portfolio management practice in any sizable organization, and would potentially have more control over the agenda implementation than we did with volunteers from 250 desperate organizations, each with its own agenda. On the other hand, it is important to value and permit the different agenda perspectives brought to the development groups by individuals with specific and real needs. The SAWG viewed its role as suggestive, not prescriptive - except in certain cases were it actively recruited like-minded people to pursue a critical objective.

A sizable body of knowledge was created in a few short years. Perhaps more importantly, some 1500 or so participants carried back to their home organizations a new knowledge base that they helped create and that has noticeably influenced many of them. Eventually the Agility Forum chose to abandon the collaborative learning groups and pursue knowledge development in a more traditional research project model. This severed the industry participation mechanism. Shortly thereafter the Forum downsized considerably and ceased to be a guiding influence for industry.

Culture of Collaborative Learning: Emerges from Action

- Identify strategic pilot areas, eg, purchasing and design.
- Start a collaborative knowledge development project in each.
- Facilitate implementation of project results with CoP support.
- Then branch out in both areas with more projects, where each project spawns a community of practice, developing a culture of collaboration within two focused areas first.
- When processes are refined and resources are sufficient, promote general collaborative learning values and branch into more areas.

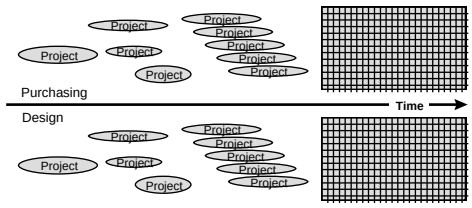


Figure 6: More Value When the Community is Helped to Help Itself

The collaborative learning groups were the formation of informal networks and communities of practice that outlived the learning projects which originally brought people together (Figure 6). These learning projects helped form the trust and respect bonds across corporate boundaries that are necessary for effective networks that trade in knowledge. In hindsight it would have been valuable for the staff group to facilitate the formation of CoPs and support them with an infrastructure of Internet tools.

As to the staff group, it was small but augmented with industry loaned executives rotated on an annual or bi-annual basis. Staff provided support functions for workshop logistics, real-time knowledge capture (workshop work-in-process journals), and Internet-accessible knowledge repository entries. More importantly, staff packaged the SAWG's knowledge agenda into collaborative learning projects and then actively recruited chairs and participants. When a chair was installed for a learning project staff backed off and provided assistance and support, not direction.

Collaborative learning projects are an affective mechanism for knowledge agenda fulfillment, knowledge diffusion packaging, collaborative culture initiation, and community of practice formation. Communities of practice are an effective mechanism for nurturing a collaborative culture and increasing the velocity and richness of knowledge diffusion.

In Conclusion

We live in interesting times. In my lifetime I've talked with a grandfather who grew up with horses and wagons and lived to see man walk on the moon. I've witnessed the introduction of television, the computer, the Internet, and robotics; and expect to live long enough to see human genetic engineering intervene in human life extension and maybe even cold fusion and anti-gravity become part of everyday life. Genetic engineering and cloning are already employed in the production of goods, while material science and atomic level manipulation technology advances rapidly. And there are already two different drugs in clinical trials that intervene significantly in the human learning process. This list goes on.

The knowledge base is exploding. The duration of value for any given piece of knowledge is shrinking as new knowledge makes old knowledge obsolete faster. This puts pressure on the speed of deployment. If useful knowledge is not deployed quickly enough it becomes obsolete before it generates a return on investment. This also puts pressure on the speed of knowledge diffusion and a focus on the anticipation of new knowledge needs.

Change proficiency in all systems of business will determine the ability to deploy knowledge effectively. At the same time, any knowledge management practice spurred into existence to deal with the knowledge explosion must recognize its own needs for being change proficient. We will continue to learn about learning and knowledge diffusion mechanisms, and this knowledge must be able to continually influence and mold any knowledge management practice an organization develops.

When an organization needs to learn quicker it must shorten the time of acquisition and diffusion of knowledge. Collaborative learning supported by a purposeful infrastructure and culture puts more diversity of thought into closer knowledge exchange and development proximity, and creates an architecture from which intelligence at the higher organizational level emerges - much as the ant hill and bee hive are said to exhibit a collective intelligence separate from individual localization.

A corporate university architecture similar to that depicted in Figure 5, with a start-up strategy similar to that depicted in Figure 6, will create and nurture a culture of collaborative learning. Figure 7 depicts a unified organizational behavior arising from shared common knowledge.

An organization with sufficient competencies in knowledge management and change proficiency, reasonably balanced to compliment each other, will be agile enough to live and maybe even lead in these interesting times. Short of a technological mishap-induced return to the dark ages, it is unlikely that knowledge generation will slow down.

In the end, though an organization may well manage knowledge, it will never control it. Viability and leadership will be as much determined by organizational *response ability* as it will by knowledge portfolio management.

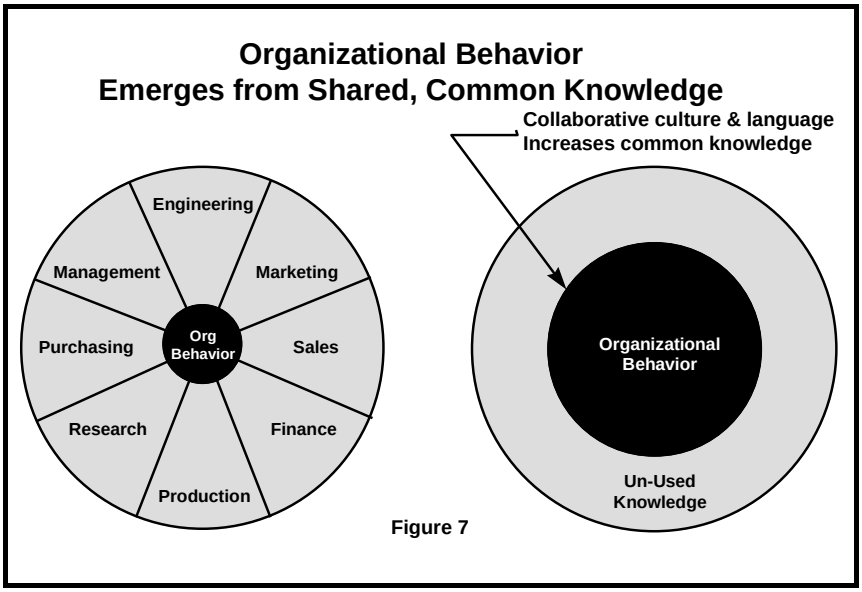


Figure 7

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