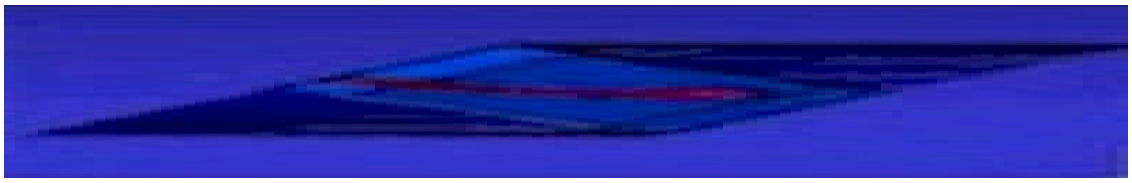

White Paper No. Fourteen

Accelerated Innovation and KM Impact

By

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Innovation, The Knowledge Life Cycle Model and Knowledge Management

Innovation acceleration is a "hot topic" in knowledge management [1]. While "first generation" or "supply-side" knowledge management focused mainly on problems and concerns of managing knowledge storage and distribution, some individuals in knowledge management have recently championed the cause of "demand-side" knowledge processing [2]. They argue that knowledge management is broader than "supply-side" activities, and that, moreover, the KM value proposition is greatly enhanced when we expand its focus to include knowledge production activities, and in particular business innovation.

This new focus of KM is on innovation. It is about managing it, and accelerating it, and it is about managing and accelerating innovations in creating business innovations. But what is innovation? There are many ways to define it, and I won't provide a definitional survey in this article. But my definition is that ***innovation is a completed knowledge process life cycle event, beginning with knowledge production and ending in incorporation of knowledge structures within business structures. Innovation acceleration then, involves continuous decrease in the cycle time of the knowledge process cycle.*** To reason intelligently about innovation it is necessary to be clear on the nature of the knowledge life cycle.

A Knowledge Life Cycle Model

Figure One provides an overview of a Knowledge Life Cycle model begun in collaboration with Mark McElroy, Edward Swanstrom, Douglas Weidner, and Steve Cavaleri [3], during meetings sponsored by the Knowledge Management Consortium International (KMCI), and further developed recently by Mark McElroy and myself [4]. Knowledge Production and Knowledge Integration are core knowledge processes in the model. Knowledge Production produces Validated Knowledge Claims (VKCs), Unvalidated Knowledge Claims (UKCs), and Invalidated Knowledge Claims (IKCs), and information about the status of these. Organizational Knowledge (OK) is composed of all of the foregoing results of knowledge production. It is what is integrated into the enterprise by the Knowledge Integration process.

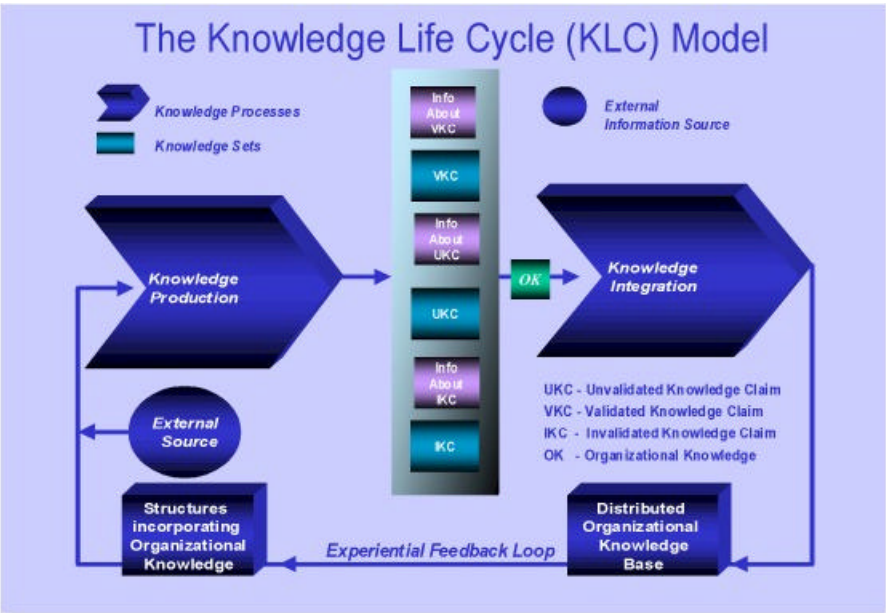

Figure One -- The Knowledge Life Cycle Model (Overview)

The knowledge integration process, in turn, produces the Distributed Organizational Knowledge Base (DOKB) and the DOKB, in its turn, has a major impact on structures incorporating organizational knowledge such as business processes and information systems. Coupled with external sources these structures then feed back to impact Knowledge Production at a later time -- which is why it's called the Knowledge Life Cycle (KLC) model.

Drilling down into knowledge production (figure two), the KLC view is that information acquisition, and individual and group learning, impact on knowledge claim formulation, which, in turn, produces Codified Knowledge Claims (CKCs). These, in their turn, are tested in the knowledge validation sub-process, which produces organizational

knowledge. Individual and group learning may involve knowledge production from the perspective of the individual or group, but from the perspective of the enterprise, what the individuals and groups learn is information, not knowledge. Similarly information acquired may be knowledge from the perspective of the external parties it is acquired from.

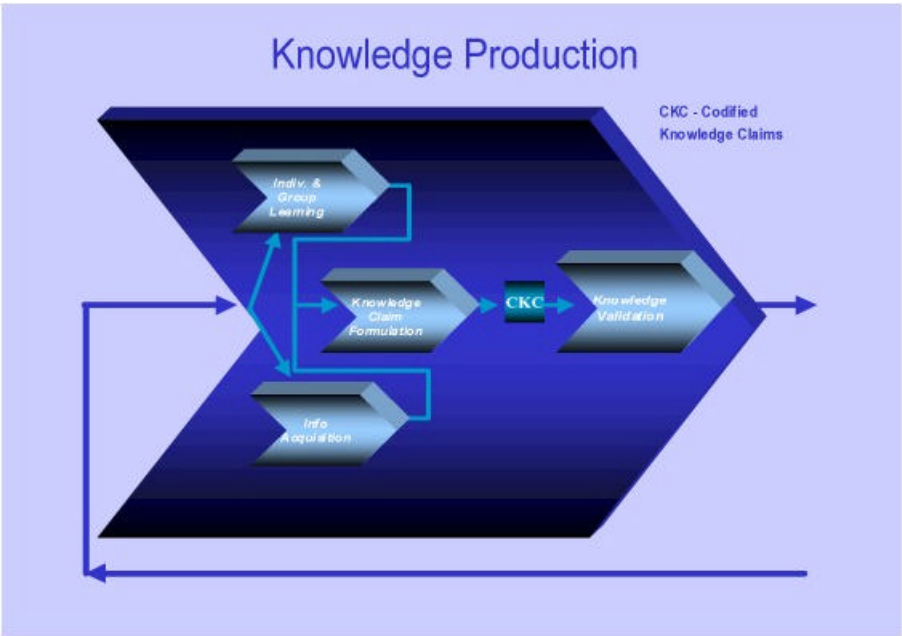

Figure Two -- The Components of Knowledge Production

Drilling down into knowledge integration (figure three), organizational knowledge is integrated across the enterprise by the broadcasting, searching/retrieving, teaching, and sharing sub-processes. These generally work in parallel rather than sequentially. And not all are necessary to a specific instance of the KLC. All may be based in personal non-electronic or electronic interactions. Here is a glossary of the major terms used in the KLC Model.

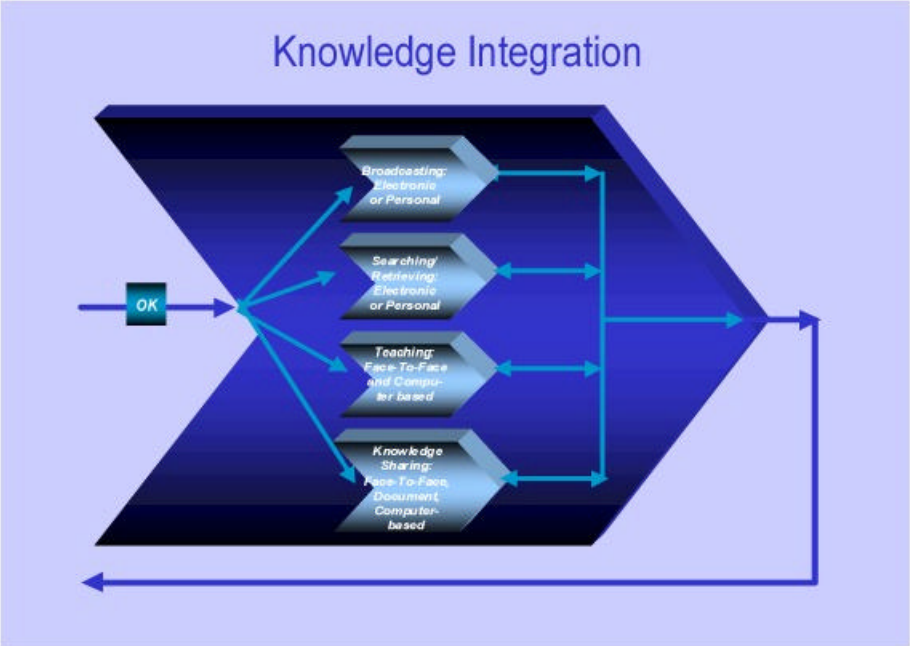

Figure Three -- The Components of Knowledge Integration

Sidebar One: Figure One Glossary

Codified Knowledge Claims **-** Information that has been codified, and is claimed to be true, but which has not yet been subjected to organizational validation.

Distributed Organizational Knowledge Base - an abstract construct representing the outcome of knowledge integration. The DOKB is found everywhere in the enterprise, not merely in electronic repositories.

Experiential Feedback Loops **-** Processes by which information concerning the outcomes of organizational learning activities are fed back into the knowledge production phase of an organization's knowledge life cycle as a useful reference for future action.

Individual and Group Learning **-** A process involving human interaction, knowledge claim formulation, and validation by which new individual and/or group level knowledge is created.

Information About Invalidated Knowledge Claims **-** Information that asserts the existence of invalidated knowledge claims and the circumstances under which such knowledge was invalidated.

Information About Unvalidated Knowledge Claims **-** Information thats asserts the existence of unvalidated knowledge claims, and the circumstances under which such knowledge was tested and neither validated nor invalidated.

Information About Validated Knowledge Claims - Information that asserts the existence of validated knowledge claims and the circumstances under which such knowledge was validated.

Information Acquisition **-** A process by which an organization either deliberately or serendipitously acquires knowledge claims or information produced by others external to the organization.

Invalidated Knowledge **-** A collection of codified invalidated knowledge claims.

Invalidated Knowledge Claims **-** Codified knowledge claims that have not satisfied an organization's validation criteria. Falsehoods.

Knowledge Claim **-** A codified expression of potential knowledge which may be held as validated knowledge at an individual and/or group level, but which has not yet been subjected to a validation process at an organizational level. Information. Knowledge claims are components of hierarchical networks of rules, that if validated would become the basis for organizational or agent behavior.

Knowledge Claim Formulation **-** A process involving human interaction by which new organizational knowledge claims are formulated.

Knowledge Integration **-** The process by which an organization introduces new knowledge claims to its operating environment and retires old ones. Knowledge Integration includes all knowledge transmission, teaching, knowledge sharing, and other social activity that communicates either an understanding of previously produced organizational knowledge to knowledge workers, or the knowledge that certain sets of knowledge claims have been tested, and that they and information about their validity strength is available in the organizational knowledge base, or some degree of understanding between these alternatives. Knowledge integration processes, therefore, may also include the

transmission and integration of information.

Knowledge Production **-** A process by which new organizational knowledge is created, discovered, or made. Synonymous with "organizational learning."

Knowledge Validation Process **-** A process by which knowledge claims are subjected to organizational criteria to determine their value and veracity.

Organizational Knowledge **-** A complex network of validated knowledge claims held by an organization, consisting of declarative and procedural rules.

Organizational Learning **-** A process involving human interaction, knowledge claim formulation, and validation by which new organizational knowledge is created.

(business) Structures Incorporating Organizational Knowledge - Outcomes of organizational system interaction. The organization behaves through these structures including business processes, strategic plans, authority structures, information systems, policies and procedures, etc. Knowledge structures exist within these business structures and are the particular configurations of knowledge found in them.

Unvalidated Knowledge Claims **-** Codified knowledge claims that have not satisfied an organization's validation criteria, but which were not invalidated either. Knowledge claims requiring further study.

Validated Knowledge Claims **-** Codified knowledge claims that have best satisfied an organization's validation criteria compared to other, competing, knowledge claims. "Truth" as we currently knowit.

Knowledge Management, the KLC, and Innovation

When we look at innovation through the KLC model, it is only an additional short step to recognize that to manage innovation we need to manage the KLC and both of its master processes. What is the relationship between managing the KLC and Knowledge Management itself?

To answer this question, we need to decide whether managing

knowledge refers to managing knowledge processes, managing the outcomes of these processes, or managing both? It has recently been stated [2, P. 87] that *"It's not knowledge management, stupid, it's knowledge PROCESS management."* But this is surely too simple. While KM is a process that manages the knowledge processes of the KLC, since those processes produce knowledge outcomes including the knowledge base, it is also true that KM indirectly manages knowledge outcomes. Or, to put the situation another way, knowledge management is most directly knowledge process management, and only indirectly knowledge base management. The knowledge processes in question are given in the KLC. So knowledge management is both process and outcome management, and so is innovation management.

The Nature of Knowledge Management

There are many available definitions of knowledge management [5], but few specifications that bring the definitions a step closer to analysis and measurement. I define KM as human activity that is part of the Knowledge Management Process (KMP) of an agent or collective. This reduces KM to the definition of KMP. And the KMP is an ongoing, persistent, purposeful interaction among human-based agents through which the participating agents aim at managing (handling, directing, governing, controlling, coordinating, planning, organizing) other agents, components, and activities participating in the basic knowledge processes (knowledge production and knowledge integration) into a planned, directed, unified whole, producing, maintaining, enhancing, acquiring, and transmitting the enterprise's distributed organizational knowledge base. This definition is another way of stating the idea that KM is management of the KLC and its outcomes. But it still needs further specification.

Let's note first that the KMP is a business process. Figure four specifies the idea that any business process including the KMP may be viewed as a network of sequentially linked activities governed by validated rule sets, or knowledge. A linked sequence of activities performed by one or more agents sharing at least one objective is a Task. A linked sequence of tasks governed by validated rule sets, producing results of measurable value to the agent or agents performing the tasks is a Task Pattern. A cluster of task patterns, not necessarily performed sequentially, often performed iteratively and incrementally, is a Task Cluster. Finally, a hierarchical network of interrelated, purposive, activities of intelligent agents that transforms inputs into valued outcomes, a cluster of task clusters, is a business process.

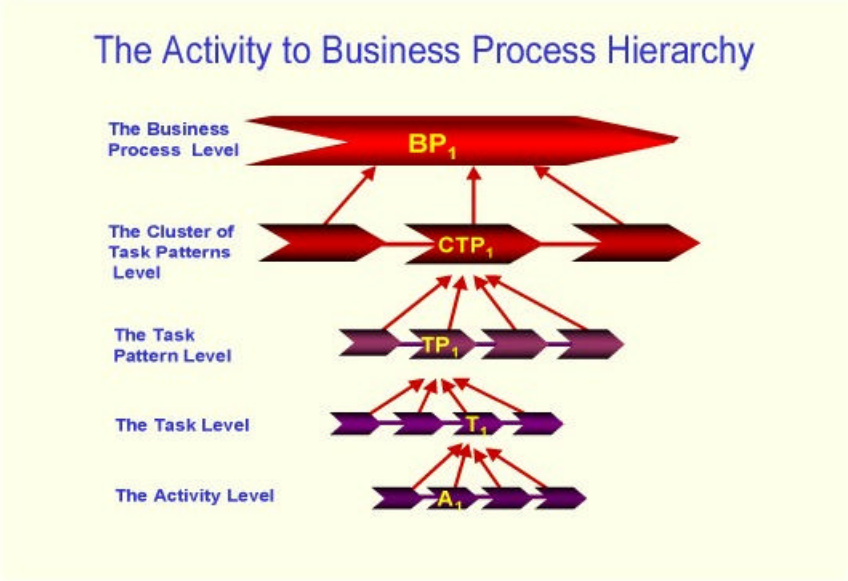

Figure Four -- The Activity to Business Process Hierarchy

I break down the KMP [6] into three task clusters: interpersonal behavior, knowledge processing behavior, and decision making behavior. Interpersonal behavior may be further categorized into:

- Figurehead or ceremonial KM activity (focuses on performing formal KM acts such as signing contracts, attending public functions on behalf of the enterprise's KM process, and representing the KM process to dignitaries visiting the enterprise);
- Leadership (includes hiring, training, motivating, monitoring, and evaluating staff. It also includes persuading non-KM agents within the enterprise of the validity of KM process activities); and
- Building external relationships -- another political activity designed to build status and to cultivate external sources of support for KM.

Knowledge processing behavior includes:

- KM knowledge production (different in that it is here that the rules for knowledge production that are used at the level of knowledge processes are specified);
- KM Knowledge Integration (affected by KM knowledge production, and also affects knowledge production activities by stimulating new ones).

Decision making behavior includes:

- Changing knowledge process rules (involves making the decision to change such rules and causing both the new rules and the mandate to use them to be implemented);
- Crisis Handling (e.g., meeting CEO requests for new competitive intelligence in an area of high strategic interest for an enterprise, and directing rapid development of a KM support infrastructure in response to requests from high level executives);
- Allocating Resources (KM support infrastructures, training, professional conferences, salaries for KM staff, funds for new KM programs, etc.);
- Negotiating agreements(with representatives of business processes over levels of effort for KM, the shape of KM programs, the ROI expected of KM activities, etc.).

The nine categories within the task clusters are the task patterns illustrated in Figure four. Further specification of KM involves breaking down the task patterns further, but I don't need to do that for this discussion. In brief, the nature of knowledge management is that it is a complex process composed of the above task clusters and task patterns. To assess its impact on innovation, we need to assess the changes in the state of the KM task clusters and task patterns and the changes in the various components of the knowledge life cycle induced by the changes in KM patterns. The changes in KM patterns are what we mean by KM interventions. Later on I will provide examples of KM interventions.

Aspects of KM Impact on Innovation

I divide KM impact on innovation into three categories: KM impact on knowledge processes; KM impact on knowledge process cycle times; and KM impact on innovation rates and innovation relevance.

Impact on Knowledge Processes

Figure five illustrates the relationship between changes in KM task patterns, tasks, and activities and changes in knowledge processes. The main point is that changes in KM cause changes in each of the components of the two knowledge processes. KM impact on knowledge processes is a set of impacts classifiable as impacts in information acquisition, individual and group learning, knowledge claim formulation, and knowledge claim validation, broadcasting, searching/retrieving,

teaching and sharing. KM impact on organizational knowledge, the distributed organizational knowledge base and other outcomes incorporating knowledge structures is indirect. But changes in these products of knowledge processes feedback to impact on future operations of knowledge processes. Though not shown in the figure they may also feedback to impact the KM process itself, provided a healthy KM process is in place.

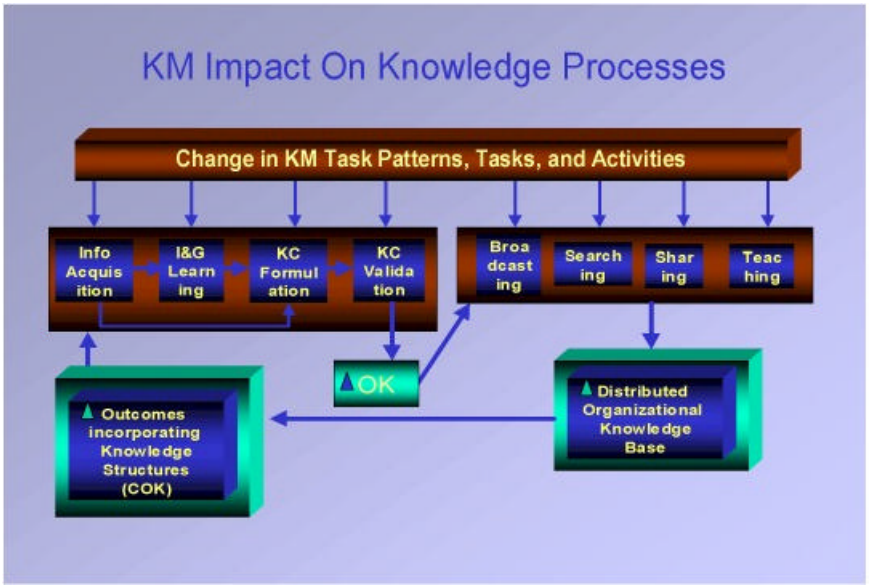

Figure Five -- KM Impact on Knowledge Processes

A more detailed classification of KM impacts can be developed from the cross-classification of KM task patterns and KLC components. There are 72 types of KM impact resulting from this cross-classification. And many more types would result if the KM task patterns were further broken down into tasks. The types of impact can serve as a guide to hypothesis formation and model construction. They provide a framework within which we can seek to formulate and test hypotheses and rules and rule sets in models. The types of KM impact can easily be laid out in a table, but I won't take the space to do that here.

Impact on Knowledge Process Cycle Times

If changes in KM have an impact on changes in knowledge process components, it is to be expected that they have this impact indirectly, through changes they induce in the KM tasks comprising these components, and that these changes, in turn, result in changes in knowledge processing cycle time. Figure six illustrates this impact of changes in KM on knowledge process cycle times. There is a cycle time for every component of the KLC. The total cycle time in any instance of

knowledge processing is the sum of the cycle times involved in that instance of knowledge processing. Note that not every knowledge processing component need be present in a given cyclical instance.

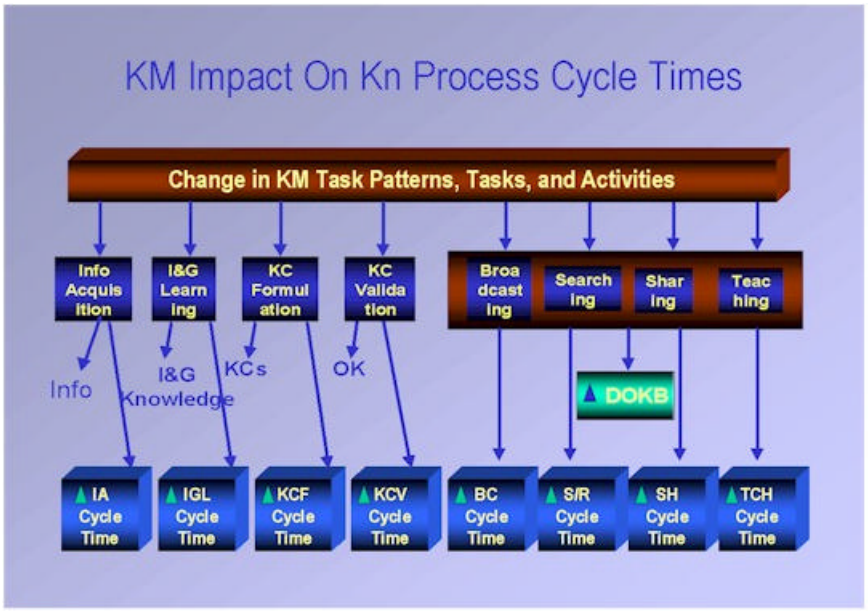

Figure Six -- KM Impact on Cycle Times

Note also, that the impact of KM may be partitioned into separate impacts on each of the cycle times associated with each of the components of the KLC. Moreover, the impacts or changes in individual cycle times are additive in determining the total cycle time changes in the KLC.

Impact on Innovation Rates and Innovation Relevance

These impacts are addressed in Figure seven. Changes in KM patterns cause changes in the KLC. Two results are changes in component and total cycle times and changes in the relevance or value of new innovations. Innovations are not automatically valuable, and increases in innovation cycle times are not automatically beneficial. Innovation relevance addresses these questions.

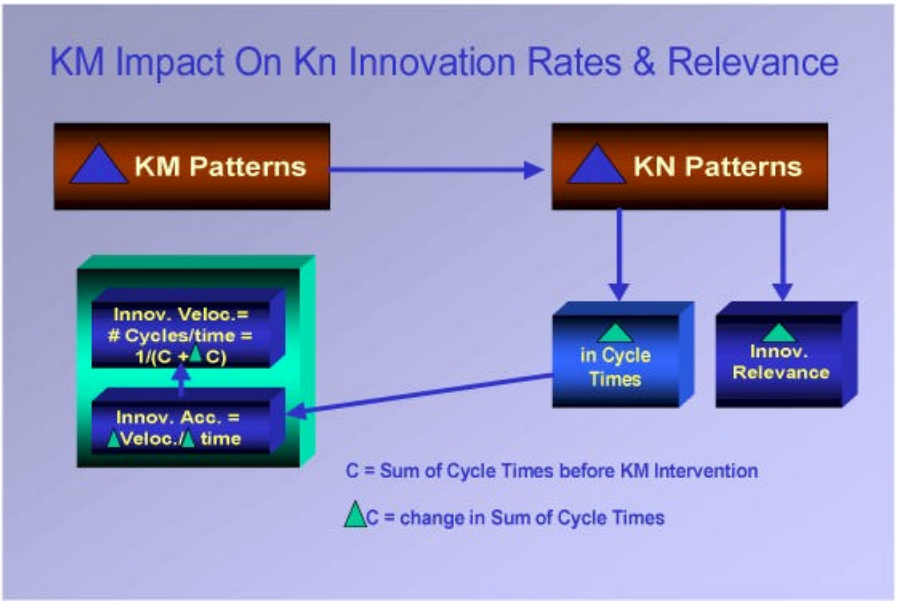

Figure Seven -- KM Impact on Innovation Rates and Relevance

The illustration in Figure seven also addresses what I mean by:

- Innovation acceleration -- the change in velocity divided by the change in time; and
- Velocity -- the number of innovation cycles per unit time (It will be a small number if time is measured in seconds, minutes, hours, days, or even weeks).
- Velocity also = 1/[the sum of the initial (before KM intervention) component cycle times and the change in the sum of cycle times after KM intervention].

KM Interventions and KM Metrics

KM process interventions are changes made in the nine task patterns and their relationships, and even more concretely, in tasks comprising the task patterns. These changes impact knowledge process components such as information acquisition, knowledge validation, knowledge sharing, and their relationships, and therefore also impact the relevance, acceleration, and velocity of innovations. In order to evaluate KM interventions it is necessary to measure their impact. In turn, this requires metrics for both KMP and KLC attributes.

There are three categories of knowledge process and product metrics necessary for measuring KM impact and evaluating any KM intervention: (1) internal metrics measuring changes in the task clusters, patterns, tasks, and activities of the KM Process, and the

products of the KMP; (2) knowledge life cycle metrics needed for measuring the impact of changes in KM on KLC process components, relationships, Innovation Velocity (IV), Innovation Acceleration (IA), and Innovation Relevance (IR); and (3) metrics for measuring the impact of changes in IV, IA, and IR on the enterprise.

Still more specifically, to validate any KM intervention one needs to analyze the impact attributable to it of changes in KM patterns on changes in metrics related to: information acquisition, individual and group learning, knowledge claim formulation, knowledge validation; broadcasting, searching, teaching, sharing; innovation velocity; innovation acceleration, innovation relevance; and indicators *external* to the knowledge life cycle such as Return On Capital Employed (ROCE), ROI, Operating Margin, and numerous balanced scorecard-type measures of organizational performance. This is the validation context of all KM interventions or KM techniques designed to accelerate innovation, or to otherwise improve the quality of the KLC. Here are some examples of the three types of metrics needed to evaluate KM interventions.

KM Process Internal and Related Product Metrics

KM process metrics include change in:

- KM knowledge production cycle times;
- KM knowledge integration cycle times;
- Frequency of change in knowledge production rules;
- Intensity of collaboration among KM agents, teams, and groups;
- Cycle time in responding to requests for competitive intelligence

KM product metrics include change in:

- Breadth of distribution of KM knowledge within the KM community of practice;
- Increase/decrease in extent of validation of various components of the KM organizational enterprise knowledge model

Knowledge Life Cycle Metrics

KLC Process Metrics include change in:

- KLC Component Cycle Times;
- Innovation Velocity;
- Innovation Acceleration;
- Intensity of Collaborative Activity in Knowledge Production

Some KLC Product Metrics include change in:

- Extent of Innovation Relevance;
- Average level of measurement of attributes in knowledge base within and across domains;
- Validation profile of various components of the knowledge base

KM-Related Enterprise Metrics

Some Enterprise Process Metrics include change in:

- Manufacturing Production Cycle Times;
- Customer Service Cycle Time;
- Intensity of collaboration in enterprise business processes;

Some Enterprise Product Metrics include change in:

- ROI;
- Profitability;
- Market Share;
- Customer Retention; and
- Employee Retention.

Some Examples of KM Interventions

The key to KM impact on innovation is KM intervention. I have argued that we must begin to measure and evaluate the impact of KM interventions on the KLC and on innovation if we want to be effective in accelerating innovation. By way of concluding this discussion of accelerated innovation and KM impact it may be helpful to provide some examples of what we mean by the kind of KM interventions that will need to be evaluated.

- **Allocate KM Resources to Support Involvement in External**

Initiatives

This may include involvement in outside consortia, think tanks, research initiatives, industry conferences, outside training programs, and industry intelligence subscription services. Impacts on information acquisition, individual and group learning, and knowledge claim formulation are likely.

- **Allocate KM Resources to Establish and Support Communities of Practice**

  This may include implementing web-based collaborative processing IT applications. The effects may include decentralizing innovation, encouraging cross-disciplinary collaboration, decreasing cycle time in individual and group learning, knowledge claim formulation, and knowledge claim validation.

- **Change Knowledge Processing Rules By Introducing a Formal Knowledge Production Methodology**

  Can impact individual and group learning, knowledge claim formulation, and knowledge validation, including establishing new knowledge validation criteria. Impact on innovation acceleration, velocity, and relevance may result, and must be carefully evaluated.

- **Implement Training Programs for KM**

  Impact can include rapid increase in awareness of the components of both knowledge processing and knowledge management. In turn, this can lead to acceleration in the various components of knowledge production especially, and to implementation of new IT infrastructure to support knowledge processing in the enterprise.

- **Allocate KM Resources to Implement an Enterprise Knowledge Portal**

  Implementing an EKP can have a comprehensive impact on all components of knowledge processing. EKPs can accelerate information acquisition, individual and group learning, knowledge claim formulation, and support all of the knowledge integration sub-processes as well. Impact however, will depend on the specific changes introduced by the EKP. A comprehensive EKP can support communities of practice, introduce a formal knowledge production methodology, and support a variety of information acquisition, knowledge validation, and knowledge integration activities, as well as a variety of KM activities.

This Paper is also available under the same title in Financial Knowledge Management, Q1, 2000

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[3] Edward Swanstrom, Joseph M. Firestone, Mark W. McElroy, Douglas T. Weidner, and Steve Cavaleri, "The Age of The Metaprise," Knowledge Management Consortium International, Gaithersburg, MD, 1999.

[4] In e-mail and telephone communications.

[5] See Yogesh Malhotra's compilation at http://www.brint.com

[6] See Henry Mintzberg, "A New Look at the Chief Executive's Job," Organizational Dynamics," (AMACOM, Winter, 1973)

Biography

Joseph M. Firestone, Ph.D. is an Information Technology consultant working in the areas of Decision Support (especially Enterprise Knowledge Portals, Data Warehouses/Data Marts, and Data Mining), and Knowledge Management. He is consulting in the areas of developing Enterprise Information/Knowledge Portal Products, and is the author of "Approaching Enterprise Information Portals," a comprehensive, full-length industry report on this rapidly emerging field. In addition, he formulated and is promoting the concept of Distributed Knowledge Management Systems (DKMS) as an organizing framework for software applications supporting Natural Knowledge Management Systems. Dr. Firestone is Chief Scientist of Executive Information Systems, Inc. (EIS), and one of the founding members of the Knowledge Management Consortium, International. A sampling of his writings may be found at the EIS web site at http://www.dkms.com, a site Dr. Firestone developed. The dkms.com web site is one of the more popular sites in data warehousing and knowledge management, and has now attained a run rate of more than 60,000 visits per year.