An EIS Professional Paper

How Knowledge Management Can Help Identify and Bridge Knowledge Gaps

By

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Abstract

Knowledge gaps and their elimination drive progress and competitive advantage. The better we are at recognizing them, the more likely the knowledge we use will get us the results we need. They are the first step in innovation. The motivation they elicit provides an important and continuing incentive for it. The following pages provide an account of:

- how and why the recognition of knowledge gaps arises out of everyday business processing and decision making;
- how knowledge gaps are closed through successful performance of knowledge processes (knowledge production and knowledge integration); and
- how Knowledge Management can help to enhance problem recognition, as well as other aspects of knowledge processing such as creating tentative solutions, and testing and evaluating them.

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Executive Information Systems Incorporated.

How Knowledge Management Can Help Identify and Bridge Knowledge Gaps[1]

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Knowledge gaps and their elimination drive progress and competitive advantage. The better we are at recognizing them, the more likely the knowledge we use will get us the results we need. They are the first step in innovation. The motivation they elicit provides an important and continuing incentive for it. In the following pages I'll provide an account of:

- how and why the recognition of knowledge gaps arises out of everyday business processing and decision making;
- how knowledge gaps are closed through successful performance of knowledge processes (knowledge production and knowledge integration); and
- how Knowledge Management can help to enhance problem recognition, as well as other aspects of knowledge processing such as creating tentative solutions, and testing and evaluating them.

How Knowledge Gaps Happen

Case 1: Suppose you're a Medical Doctor attached to a Health Care Center. You want to treat a patient with an infection. You believe you can cure the infection by prescribing Ampicillin. You set out to order it through the Center's Order Entry System. The system confirms your recommendation. You order the Ampicillin, which is effective when administered to your patient. Figure 1 places a conceptual interpretation on this very common sequence. It begins with a gap between what you want (to cure your patient) and the present state of affairs. I call this the instrumental behavior gap. To close it, you use your previous knowledge about infections to decide to prescribe Ampicillin. You take action, by ordering Ampicillin, and after having it administered to your patient, you monitor the result and evaluate the outcome. If the result isn't satisfactory, you can begin again by planning and deciding on a new treatment

Now, in this Case 1 scenario, you haven't produced any new knowledge beyond knowledge of particular facts accompanying acting, monitoring, and evaluating the immediate results of your actions. Rather, you used previous knowledge

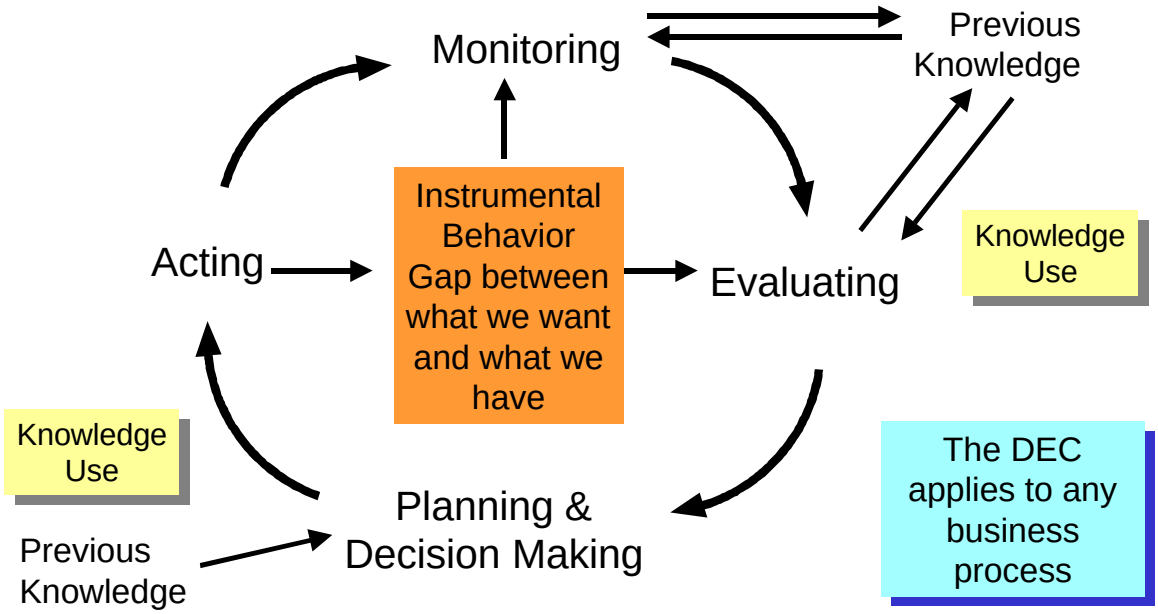

Figure 1 -- The Decision Execution Cycle

along with knowledge of particular facts. *There were no knowledge gaps affecting what you did.* You performed a number of sequential tasks that we may think of as an operational business process or work flow and also used your Center's Order Entry System. You learned some facts during this process, and the success of your prescription reinforced the previous knowledge you had about what should be prescribed in situations like this one. In other words, you engaged in single-loop learning while you performed an uneventful decision execution cycle.

Case 1a: Let's vary Case 1 a bit. Suppose that after you logged onto the Order Entry System, it reported a previous allergic reaction of your patient to Ampicillin. Now your previous knowledge, i.e. the knowledge available in your memory, and the knowledge available in your organization's information system, suggest different conclusions and you no longer are sure whether you should be prescribing Ampicillin, or some other therapeutic measure for your patient. You now have recognized a problem: specifically, you don't know what therapy to prescribe and you must find out in order to treat your patient. That is, your problem is an epistemic problem, a knowledge gap between what you know and what you need to know. Figure 2 illustrates the change in the decision execution cycle when a problem arises.

In Cases 1 and 1a, I gave you an example of how a problem may arise from a business process that you are carrying out yourself. This example was abstracted from the Partners HealthCare case reported on recently by Thomas Davenport and John Glaser in the June 2002 issue of The Harvard Business

Review. However, knowledge gaps may also arise out of changes in business processes imposed by external authorities.

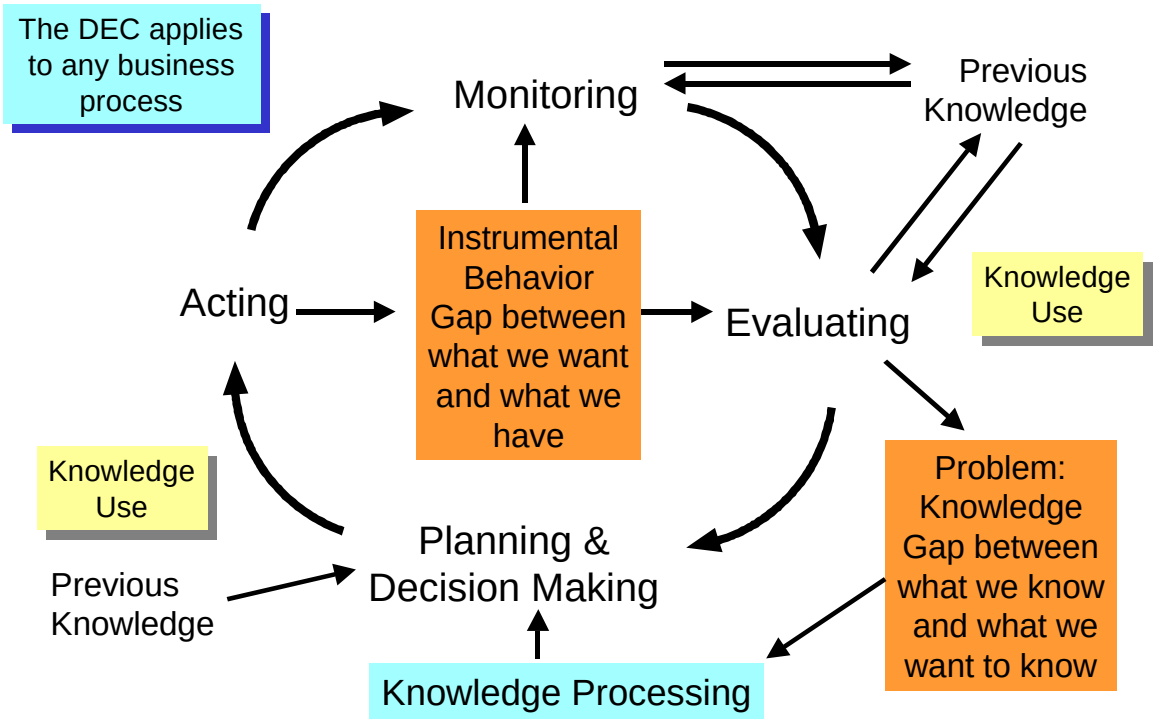

Figure 2 -- Adding Problems to the Decision Execution Cycle

Case 2: A clear example from the Government Sector occurred some years ago during the Carter Administration in the United States. During this period there was great concern about bringing deficits under control and distributing scarce U.S. Government funds according to "need". The Farmers Home Administration (FmHA), a major loan and grant agency in the U.S. Department of Agriculture, became caught up this concern, and mandated that its Program Evaluation Office provide funding formulae for allocating its loans and grants according to need. This left the Program Evaluation Office with a knowledge gap. It had no idea how to construct such formulae.

How We Close Knowledge Gaps

To close knowledge gaps, one needs, simply, to *solve problems*. In the Partners HealthCare example, it was necessary for the Doctor involved to *decide* whether the system's recommendation to avoid using Ampicillin would produce a greater benefit/cost outcome than any other competing therapy including his own initial prescription of Ampicillin. In order to do that he needed to consider the alternatives, evaluate them, and learn for himself what the best choice for treatment was. The decision he made, after using the system to determine that

the patient's past allergic reaction was a minor and easily treatable rash, was to reject the system's recommendation and to stick with his original prescription of Ampicillin for his patient.

In Case 1A, then, the Doctor (a male) had to (1) recognize his problem, (2) seek and acquire information to help him solve it, (3) think about the alternatives and perhaps formulate them more clearly either in his mind or on paper. Then he had to (4) evaluate the competing alternative solutions, select the one he thought would cure the infection with acceptable and treatable side effects after rejecting the other alternatives as errors, and finally (5) use the knowledge he learned by over-riding the system and ordering the Ampicillin.

Three of the most important steps in this five-step pattern were expressed in various writings by Karl Popper, who called the problem-solving pattern illustrated in Figure 3, "the Tetradic Schema." Popper did not explicitly distinguish information acquisition as a separate step in problem-solving, but there is no harm in calling explicit attention to it as an activity that often precedes formulating alternatives. Popper also did not mention the step of "using knowledge" as part of the tetradic schema. But I have gone beyond the schema and included it here to emphasize (a) that solutions are made to be used and (b) that when a problem is solved, the knowledge is used in the business process that produced the original problem and awoke the learning incentive. Finally, Popper included a second problem (P_2) at the end of the pattern to indicate that solutions to problems usually suggest new problems (knowledge gaps) and also to indicate that life involves continual problem solving.

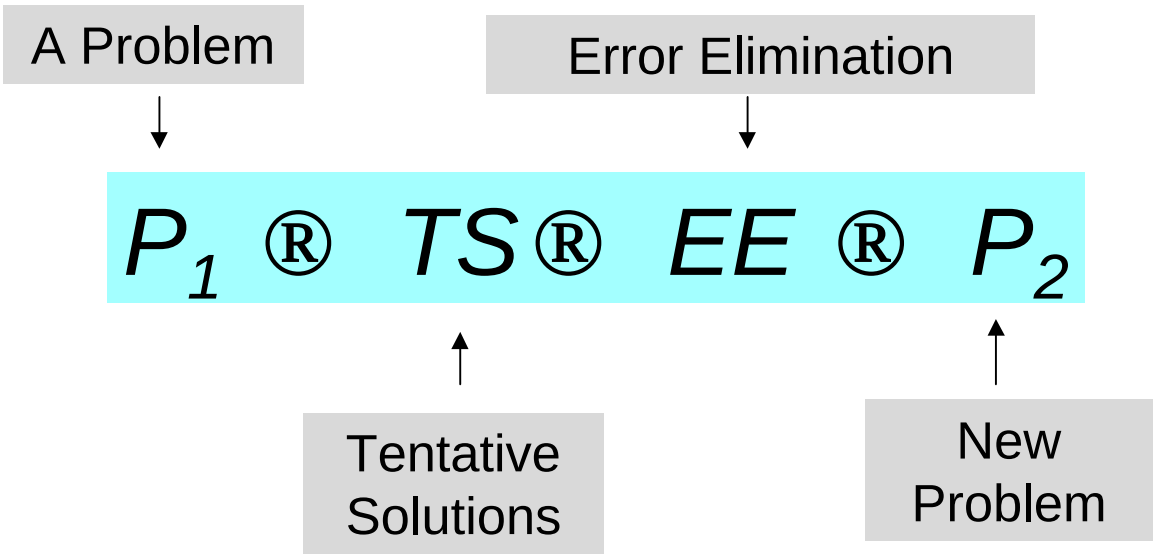

Figure 3 -- Popper's Tetradic Schema

In Case 2, the FmHA Needs Assessment Capability (NAC) project, the same pattern of problem solving I described in the story about the Doctor at Partners HealthCare can also be observed. During the FmHA project, there were extensive efforts at information acquisition. Literature reviews, interviews with personnel of other Federal agencies, facilitation sessions with national, state, and local level decision makers were all used as sources of information to provide a foundation for formulating tentative solutions. In turn, the alternatives were arrived at using group decision making processes with the decision makers just mentioned participating, along with psychometric scaling techniques, mathematical modeling, and multivariate statistical analyses of census, expert judgement, program, and other Federal data to generate alternative formulae for consideration. Finally, the same data and analytical techniques were used in many months of effort to eliminate errors in the formulae and to control for other factors biasing the effort to measure need across states and counties.

The problem life cycle at FmHA was much broader in scope than the narrow example I extracted from the Partners HealthCare case. Its duration, however, was not minutes or hours, but years, and it contained many smaller-scale problem life cycles within it. This highlights the important point that the same pattern of problem-solving can characterize problem life cycles of varying scope and duration. The pattern is fractal in nature and scales across different levels of organization.

So, in the final analysis, we close knowledge gaps, by following the pattern expressed in the tetradic schema. And when we look at this schema closely there are at least four important things that we must understand about it in the context of its use in organizations.

- First, the tetradic schema is a theory about how knowledge is produced by humans either individually or in systems;

- Second, according to this theory, there is nothing deterministic about how we close knowledge gaps and solve problems. Rather, we do this in the end ***by the application of trial and error elimination***, and the processes of formulating the trials and eliminating the errors is an emergent one, and at the level of groups and organizations involves self-organization;

- Third, closing knowledge gaps is, in the end, about adaptation. It is, to paraphrase Popper, about killing our bad ideas before they kill us; and

- Fourth, at the level of groups and organizations, problem solving and knowledge use are not enough to both “bridge knowledge gaps” and bring knowledge into use. ***In addition, we must recognize a process, called knowledge integration that links problem solving, also called knowledge production, with knowledge use.*** That process,

which involves knowledge sharing and other activities facilitating knowledge distribution throughout the organization, joins the knowledge production process in forming the Knowledge Life Cycle (KLC), a construct that my collaborator Mark W. McElroy and I have discussed at length in our books and many other publications. The outcome of any instance of the KLC is a contribution to what we call the Distributed Organizational Knowledge Base (DOKB): the products of past KLCs distributed across the various information systems and minds in the enterprise. The DOKB, in turn, provides the previous knowledge I identified earlier in Figures 1 and 2, as the knowledge that gets used in operational business processes. Figure 4 illustrates the DOKB which contains both mental knowledge and knowledge embedded in cultural products such as documents and information systems.

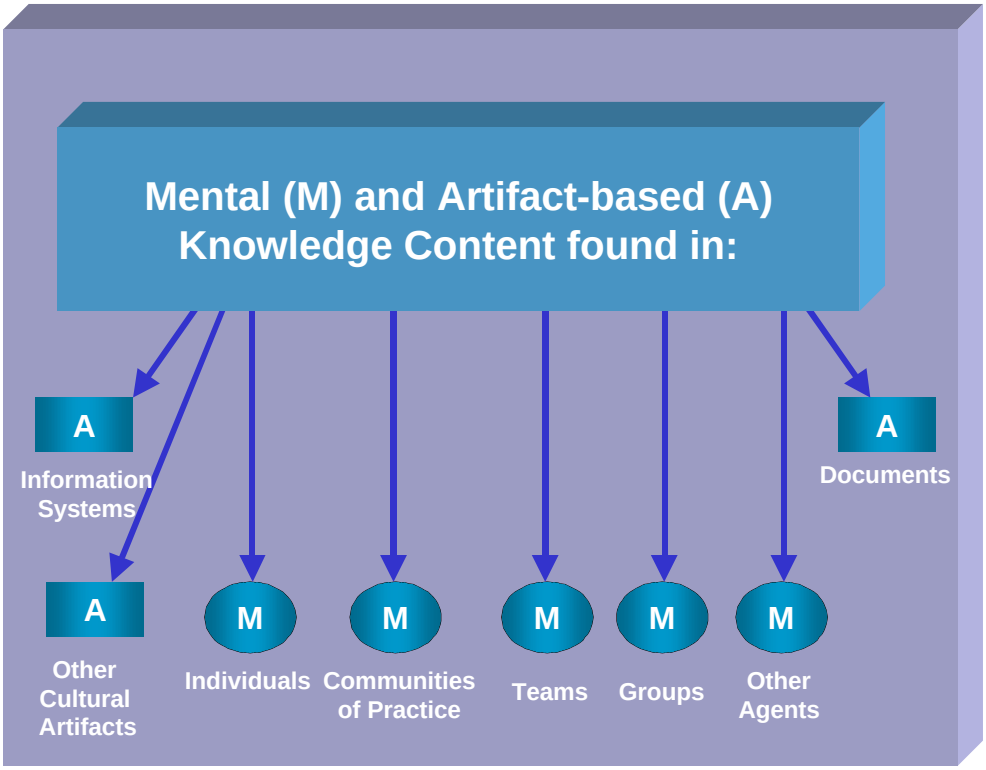

Figure 4 – The Distributed Organizational Knowledge Base (DOKB)

KM and Enhancing Problem Recognition

A short definition of Knowledge Management is that it is the set of activities we use to enhance the processes that identify and bridge knowledge gaps and that, further, bring the resulting new knowledge to everyone who needs it for decision

making and action. The first of the processes focusing on identifying and bridging knowledge gaps is problem recognition. It is at the boundary between operational business processes and knowledge processes and also at the boundary of the Knowledge Manager's authority, since people performing business processes ***under the direction of Operational Managers*** play an important role in recognizing everyday problems in business processes. So how can Knowledge Management enhance problem recognition capability when much of problem recognition activity is beyond its authority?

First, the importance of problem recognition as the first step in adaptation must be emphasized throughout the enterprise. This won't happen without agreement among key executives that problems must not be "swept under the rug," but confronted so that they may be solved. Even then, we must expect that many operational managers and operational business process participants will not want to "see" that the gap between expectations and outcomes is serious enough to justify recognizing that a gap between what they know and what they need to know exists.

Knowledge Management can assist in moderating the natural fears of people by offering *Problem Recognition and Communication Workshops* to employees. The objective of these workshops should be to train people in:

(1) understanding why problem recognition, in the sense of pointing to knowledge gaps, is important for competitive advantage, organizational effectiveness, and job performance;
(2) self-evaluating the results of their activities;
(3) recognizing when outcomes are falling short of their expectations;
(4) recognizing what type of knowledge and capability they need to overcome the performance shortfall; and
(5) communicating about the problems they recognize.

The workshops should use case study, knowledge café, and story-telling techniques since an important goal would be to provide participants with a variety of interpersonal perspectives on the areas to be covered. It is also important that sharing perspectives in a workshop environment can begin to create a community that will reinforce the idea that problem recognition is important. This community may then be organized as a *Community of Practice* (CoP) after the workshop is over and Knowledge Management can make a further and continuing contribution by moderating the CoP.

Second, an important barrier to problem recognition is getting "feedback" on the results of their activities to people, so they can do a good job of monitoring and evaluating the consequences of their decisions. In organizations with active Quality Management, or Balanced Scorecard, or other Performance Monitoring programs there is a great emphasis on measuring outcomes and on reporting, and this provides a good foundation for recognizing knowledge gaps where they

exist. Knowledge Management programs should support metrics development and implementation activities throughout the organization, and *should develop a Knowledge Management Metrics Program* covering KLC processes, Knowledge Management activities, and knowledge outcomes. KM programs can support metrics development generally by *performing research and development (if necessary) on methodologies for developing and implementing metrics* and by sharing this knowledge with staff performing other business processes. Further *training initiatives by KM staff* may also be a good way of supporting metrics development throughout the organization.

Another aspect of providing feedback to people so they can recognize problems is to *use Information Technology* to provide relevant information (and sometimes knowledge) that is "baked into the jobs" of knowledge workers, to refer again to the Davenport and Glaser article and Case 1a. Here, the Doctor perceived the existence of a problem after the order entry system reported the previous allergic reaction of the patient, an example of timely feedback tied to the Doctor's role of ordering prescriptions, that stimulated problem recognition and an individual level KLC performed by the Doctor involved. More generally, I've written extensively (*See Enterprise Information Portals and Knowledge Management,* KMCI Press/Butterworth-Heinemann, 2003 and various papers on my web site at www.dkms.com) about Enterprise Information Portals and their capability to provide alerts to knowledge workers that are relevant for their jobs. As portal technology continues to develop into full-fledged Distributed Knowledge Management Systems (DKMSs) integrating a variety of individual tools into true composite applications, it will be possible to provide "baked in" information to decision makers throughout their Decision Execution Cycles and work flows. In the meantime Knowledge Management Initiatives should *include portal solutions that provide "alerts" in key work flows* of the kind illustrated by the Partners HealthCare example.

Third, the most important way for KM to enhance the problem recognition capacity of an organization is to persuade it to accept a policy of "openness" in problem recognition. That is, a policy of maintaining freedom for all participants in business processes to state that a knowledge gap affecting performance exists and to communicate that view to as many others in the organization as they care to without fear of reprisal. Openness here will produce distributed problem recognition and greatly increase the probability that problems will be addressed, provided that the enterprise has the capacity to address them.

In addition, such a policy requires Knowledge Management to receive and allocate resources for an Information Technology infrastructure that will empower staff to exercise this freedom. In practical terms that means, these days, a portal system that will allow the free publication of newly identified knowledge gaps in the context of the business processes, work flows, and types of decisions that generated them.

KM and Enhancing Our Capability To Think Up Solutions

Once problems are recognized, knowledge workers need to formulate tentative solutions, or, if you like, knowledge claims stating them. Keeping in mind that Knowledge Managers don't produce solutions unless they address problems generated in knowledge processing rather than problems generated in operational business processing, what can Knowledge Managers do to enhance the processes and work flows knowledge workers use to arrive at tentative solutions? The short answer is that there is a great variety of things they can do, including social, technical and combined interventions aimed at policies, social attitudes, competencies, IT infrastructure, recruitment, social networks, the Distributed Organizational Knowledge Base, and many other targets. Here are some of the more important initiatives that can improve knowledge claim formulation and its outcomes.

First, ***introduce openness to new ideas as a policy*** and get the organization to commit to it. Right now, most organizations restrict freedom to formulate tentative solutions to problems to a relatively small corporate elite composed of either managers themselves or research specialists in various disciplines. These practices are maladaptive because they artificially restrict the problem-solving capacity of the enterprise and they also provide an excuse for restricting access to information and some aspects of previous knowledge to the few who most obviously need it for their problem-solving activities. Openness to new ideas, expressed as openness in Knowledge Claim Formulation, provides, in contrast, for *distributed knowledge creation and discovery*, and for using the inventiveness and talents of everyone in the enterprise to close knowledge gaps.

Second, keeping in mind that ***acquiring information from sources external to the organization***[2] is an important aspect of formulating tentative solutions, Knowledge Managers also need to provide knowledge workers with the most advanced search and navigation technology available to support efforts at problem-solving. This concern is not a one-time thing. Search and navigation technology is continually improving its capability to find and retrieve relevant information. Knowledge Managers who don't track and acquire improving capabilities in this area place their enterprises at a competitive disadvantage.

Using technology to acquire external information is not, of course, a matter of applying information technology alone, or even primarily. The whole panopoly of traditional techniques: acquisition of paper documents, training by external sources, professional conferences, visits to other organizations, meetings with external parties, telephone calls, etc. are all necessary in acquiring external information.

Third, current knowledge bases don't distinguish knowledge from information. They don't record the track record of past performance of knowledge claims used by the enterprise. So, from the point of view of people using them, everything in

the knowledge base is just information. It would be a big help to people thinking up new solutions to confront their thinking with past organizational knowledge, as well as their own personal knowledge. But it is hard to do that in the absence of real knowledge bases. It should be a priority of Knowledge Managers to construct real knowledge bases ***including "Best Practices" systems that track the performance of Best Practices***. Having access to such knowledge bases will enable knowledge workers to create better new solutions in less time.

Fourth, Knowledge Managers should encourage the formation and use of Communities of Inquiry (CoI). A Community of Inquiry is a type of CoP. One of its distinguishing characteristics is openness in Knowledge Claim Formulation, a characteristic often associated with CoPs generally. But CoPs can be characterized by a stifling social consensus that leaves little room for new ideas, while CoIs maintain openness to new ideas as a matter of policy and as a consequence of other necessary attributes of CoIs.

Fifth, Knowledge Managers should introduce training for knowledge workers in the use of social technologies for generating new ideas, in addition to CoIs. Knowledge Cafés, already used in Knowledge Management, are one of these. Verna Allee's ValueNet Works™ are another. But there are much older, better-tested social technologies for group decision making that are very effective in supporting knowledge claim formulation. They include Delphi Technique, Nominal Group Technique, Group Value Measurement Technique (GVMT), Team Analytic Hierarchy Process (TAHP), and a variety of group facilitation and focus group processes. The older techniques have frequently incorporated psychometric scaling techniques producing ratio scales developed from judgmental data gathered during the group decision process. Such scales are very useful in developing models, including models of the causal, forecasting, measurement, and value assessment variety.

In the FmHA case study referred to earlier, GVMT was used along with psychometric scaling techniques to develop a variety of value assessment models focusing on overall, community, housing, and other forms of need of states and counties for FmHA loan assistance. The resulting ratio scales exhibited high logical consistency and statistical reliability across panels of experts. And models calibrated against the judgmental scales were highly correlated to a variety of census data variables thought to measure different aspects of "need".

Sixth, one way to increase capability to generate new ideas is to explicitly recruit individuals whose history exhibits an ability to do this. Knowledge Managers should be influencing personnel policies in their organizations to introduce such policies.

Seventh, organizations vary in their competence to perform analytical modeling and computer simulation and statistical analysis. Though these techniques are

apparently not overly popular in Knowledge Management today, a lengthy history of academic, corporate, and government work shows that they are invaluable tools in generating new knowledge claims and ideas. Knowledge Managers should encourage increased corporate competency in this area where it is lacking, and also support policies acquiring the necessary software to allow knowledge workers to use relatively sophisticated modeling techniques even where they lack formal training. Of course, Knowledge Managers should also support training in using these analytical tools, which need not be extensive if the software that has been acquired is designed for "power users" rather than data analysis or software professionals.

Eighth, I haven't said much yet about Information Technology initiatives that support generating new ideas. Enterprise Information Portal (EIP) systems, of course, can integrate many applications including the search, retrieval, and navigation applications I mentioned earlier that support acquiring information. Increasingly, EIPs incorporate content management and collaboration applications that can support distributed access to publishing and communicating new ideas, as well as forming and maintaining CoPs. Some EIP products also offer Business Intelligence, Reporting, and sometimes even sophisticated analytical and social technology applications such as Team AHP.

EIPs, however, can't help to distinguish knowledge from information, and therefore do not provide real knowledge bases in which previous knowledge can be distinguished from previous information. To support this need, Knowledge Managers must develop and implement a product that doesn't exist yet,[3] namely the Knowledge Portal. A Knowledge Portal is distinguished from an Information Portal precisely because it distinguishes knowledge from information based on its tracking of the previous performance of knowledge claims in the face of testing and evaluation. I've written extensively about Knowledge Portals, beginning with the first published paper on the subject in March of 1999. Chapter 13 of my book, *Enterprise Information Portals and knowledge Management* develops the Enterprise Knowledge Portal (EKP) concept in detail.[4]

Ninth, formulating new and promising knowledge claims is often a matter of using analogy.[5] We develop new knowledge claims by recognizing similarities between the problem situation we are addressing and other problem situations for which we have previously developed successful knowledge claims. We can recognize similarities in objects, attributes, relations, and systems, and by placing similar things in correspondence we can then develop analogues of knowledge claims developed previously for us to use in problem situations.

People differ widely in their ability to think of and use analogies to develop new knowledge claims. But abilities of this kind can be enhanced through training and game playing emphasizing the creation and use of analogies. I recommend that organizations develop training programs in analogy to increase their production of high quality knowledge claims.

Again, how can Knowledge Managers enhance organizational capability to generate new ideas? I began to count the ways for you just above, but I won't do more than scratch the surface here. It's perhaps enough to leave this subject with the thought that there is a lot of continuing effort for Knowledge Management to do in this all-important area, including impact analyses of the effects of various policies and programs.

KM and Enhancing Our Capability To Test and Evaluate Solutions

The motto for Knowledge Managers interested in enhancing this area to help in bridging knowledge gaps has to be, once again, "let me count the ways" I can help. Many of the recommendations I put forward in the previous section apply here too, but the reason why they are proposed in this context is somewhat different. Again, I can do no more here than scratch the surface in describing KM initiatives that may be effective in this area.

First, and perhaps most important, is that Knowledge Managers establish a policy of openness to criticism from any knowledge worker in evaluating knowledge claims, backed by training orienting knowledge workers to the critical perspective. Why criticism? Because no new knowledge claim is certain and any claim may be superceded by new experiences. Knowledge claims must be as strong as possible if they are going to effectively support decisions. And we can make them strong by subjecting them to error elimination through testing and evaluation by a non-homogeneous group of contributors ranging over the enterprise and bringing many different perspectives to the table.

Testing and evaluation, in turn, proceeds through critical evaluation of knowledge claims and attempts to refute them, not through detailing support for them or counting instances of such support. Support for any knowledge claim is cheap to come by. It is easy to provide instances where a knowledge claim apparently supports a framework or theory, especially if the knowledge claim is highly probable because it is fairly empty and does not assert too much. But it is much more difficult for a knowledge claim or set of knowledge claims that assert much to survive open and honest criticism from a distributed group with multiple perspectives.

Distributed Knowledge Claim Evaluation (KCE) produced by openness to criticism is even more important than Distributed KCF. It is our bad ideas that will either kill us or cost us dearly, as examples such as Enron, WorldCom, Tyco, Arthur Andersen and others teach us, and KCE is our way of defending against them. We need to think up new ideas in order to solve our problems. But new ideas are not enough. We also need new ideas that are both good and relevant to our problems. KCE is our human way of arriving at that kind of knowledge. And Distributed KCE is the way organizations can best ensure that KCE will be effective in eliminating errors, because the multiple critical perspectives it

introduces into the KCE process are the best guarantee that weak knowledge claims will not survive error elimination.

Introducing openness in KCE ought to be supported by training in how to implement and live with such a policy. Workshops in this area are essential because criticism runs counter to organizational practice and culture. Criticism is not only not encouraged, it is also resented. But it is essential that people learn to live with criticism of their knowledge claims and be comfortable with it, if effective problem solving is to occur. The organization that values and lives with criticism is the organization that can best adapt to its challenges and to changes it will face in the 21st century. The organization that values consensus above all, is the organization that will produce ineffective knowledge and will fail to adapt to its environmental challenges.

Second, it's much harder to evaluate new knowledge claims, when the record of performance of pre-existing knowledge claims is not available. So, an important area of focus in this category, as it was for enhancing capability to generate new ideas, is developing real knowledge bases that do track the performance of the knowledge claims in them, not simply information or databases claiming the "magical" label "knowledge".

Third, Communities of Inquiry, recommended earlier for enabling KCF, are also essential for Knowledge Managers to encourage because they support openness to criticism and continuous testing and evaluation of knowledge claims. In CoIs, community agreement on the survival of a knowledge claim does not establish or justify that knowledge claim. In fact, participants in such communities realize that knowledge claims cannot be established and justified, but only criticized and subjected to tests in the pursuit of error elimination.

Fourth, Group Decision Processes (GDPs) are great settings for KCE, as long as they don't force consensus on the participants. Instead the processes should be designed as places in which critical evaluation of knowledge claims is protected and encouraged. Each of the processes I named earlier can be implemented to emphasize protected criticism. In training knowledge workers to implement GDPs, Knowledge Managers should include training in designing GDP components that call forth criticism and evaluation, as well as new ideas.

Fifth, how many organizations now attempt to hire people for their skills in criticism and evaluation? Enhanced capabilities for testing and evaluating knowledge claims can be gained by hiring knowledge workers who excel at these activities. Knowledge Managers should attempt to institutionalize such qualifications in the recruitment policies of their organizations.

Sixth, analytical modeling, simulation, and statistical analysis tools, already recommended because they're useful in generating new knowledge claims, are also important in testing and evaluating them. These tools provide ways of

empirically testing some knowledge claims and measuring the degree of their departure from other measures independent of such claims. They also provide for comparing competing alternatives in rigorous and precise ways that make it much easier to select among alternatives. As we'll see shortly, many evaluation criteria may be applied in criticizing knowledge claims and eliminating bad ideas. Where analytical techniques are particularly important is in supporting evaluations of empirical fit and logical consistency of competing knowledge claims.

Seventh, one of the most important initiatives Knowledge Managers can take to enhance KCE is to change the already existing, but largely implicit and uncodified, framework of perspectives and criteria for performing it. These frameworks differ in their coherence and content across organizations and even across groups within a single organization. They are also likely to rely heavily on the criterion of the authority of the source of a knowledge claim as a test for evaluating that knowledge claim.

Very few writers in Knowledge Management consider the role of Knowledge Managers in influencing KCE. Thus, we don't know what we know about KCE. Knowledge Managers need to find that out, and then need to introduce changes in their organization's framework that will support consideration of competing alternatives and error elimination in them.

In Chapter 5 of our new book *Key Issues in the New Knowledge Management*, Mark McElroy and I have offered a framework for KCE to help Knowledge Managers begin to address how they can enhance it. *The idea of "fair comparison" of competing knowledge claims is fundamental to our perspective*. We contrast "biased" knowledge claim evaluation with knowledge claim evaluation through fair comparison and assume further that KCE is more effective, in the sense that it fulfills certain success criteria, when it is characterized by fair comparison and less effective when it is characterized by bias. *Thus, we believe that KM-induced changes in knowledge processing rules and criteria that increase the degree of fair comparison also increase KCE effectiveness, and changes that increase the degree of bias decrease its effectiveness.*

Normatively, of course, one should seek to increase KCE effectiveness and therefore increase the degree of fair comparison. We believe this can be done at the level of knowledge processing by:

- First, fulfilling background requirements (the necessary conditions) for fair comparison among the members of a set of competing knowledge claims; and then,
- Second, implementing comparisons among the members of this fair comparison set, based on a number of criteria that allow us to choose

among the knowledge claims of the set based on how its members perform on various tests.

The theory of fair comparison specifies *equal specification of members of the comparison set, continuity, commensurability,* and *completeness of the comparison set* as four necessary conditions of fair comparison. It also names *logical consistency, empirical fit, projectibility, systematic fruitfulness, heuristic quality, systematic coherence, simplicity,* and *pragmatic priority* as criteria for evaluation of competing alternatives once a fair comparison set is constituted. In Chapter 5 of *Key Issues, . . .* , we discuss what we mean by each of the above criteria, and also point out that in KCE our procedures for combining criteria can range from the very informal to the highly formal. Informality in combining criteria is what we normally do.

Eighth, Knowledge Portals are essential for providing an IT foundation for enhancing KCE. They can support openness to criticism, testing and evaluation in communities of inquiry, and group decision processes, new frameworks and perspectives for evaluating knowledge claims, and the distinction between knowledge and information for which error elimination is so necessary. Most importantly, however, Knowledge Portals can provide support for constructing and maintaining the record of performance of competing knowledge claims. That is why their implementation is so necessary for Knowledge Managers seeking to enhance their organization's capability to test and evaluate knowledge claims.

KM and Enhancing Individual and Group Learning

In the earlier discussion, I've been somewhat vague about the levels of organizational interaction relating to problem recognition, thinking up new ideas, and testing and evaluating solutions. Now I want to make the point clearly that we need to distinguish among hierarchical levels of interaction in organizations where we have individuals, groups, groups of groups and individuals, and organizations all interacting. Once we recognize this, we can also see that knowledge gaps are bridged at various levels of organizational interaction and at each level we can identify problem recognition, thinking up new solutions, and testing and evaluating new solutions. Fundamentally "bridging a knowledge gap" is another way of referring to the successful outcome of a learning process, and therefore we can conclude that learning at individual and group levels bridges knowledge gaps at these levels. Furthermore, it's easy to see that bridging knowledge gaps at the individual and group levels produces (a) knowledge at those levels, which is not yet knowledge at the level of the organization and (b) potential solutions to problems at the organizational level. In other words, individual and group learning, along with acquiring external information, produces new ideas for organizational level problem solving.

Techniques for enhancing individual and group learning are pretty much the same as those I've already mentioned for problem recognition, thinking up new

ideas, and testing and evaluating solutions more generally. However, shifting the focus of our attention from the phrase “bridging knowledge gaps” to “learning” provides an opportunity to introduce the idea that a new focus in information technology has been developing around the distinction between Learning Management Systems (LMSs), which are applications for managing generalized training through courseware, and Learning Content Management Systems (LCMSs), which are applications that support the delivery of information to individuals on an as-needed basis for assistance in problem solving. In other words, LCMSs support learning and problem solving in the concrete context of practice, learning while doing one’s job, rather than learning in the context of organized subject matter.

LCMSs, especially when included in an Enterprise Information Portal context, can provide substantial assistance in problem recognition, and thinking up new ideas at the individual level. Knowledge Managers, should therefore recommend and support establishing such systems as a very practical way of enhancing individual and group learning.

KM and Enhancing the Distributed Organizational Knowledge Base

Since it contains all of both the mental and cultural products of the organization, the DOKB is the outcome of all of the processes in the Knowledge Life Cycle, not just those directly concerned with “bridging the knowledge gap”. Nevertheless, the processes I’ve discussed so far all feed the DOKB, along with various KM activities and the knowledge integration process. Thus, the quality of the DOKB is likely to be enhanced if the other processes are enhanced. That said, KM initiatives can specifically enhance the quality of the DOKB if it supports and recommends IT initiatives that manage DOKB content to: distinguish knowledge from information on the basis of the track record of each knowledge claim in surviving error elimination. Without such enhancement only the mental side of the DOKB, the side of it concerned with belief knowledge, will distinguish between knowledge and information. The cultural side, concerned with knowledge claims will not distinguish knowledge from information.

In my EIPKM book, referred to earlier, and in many papers available at www.dkms.com, I’ve specified the technical architecture of the Distributed Knowledge Management Systems (DKMSs) and Enterprise Knowledge Portals, that, if implemented would provide such a distinction. I think these are the only IT applications yet proposed that would introduce this necessary enhancement in existing DOKBs, and I recommend that Knowledge Managers propose and support implementation of such systems since they are at the heart of knowledge production, knowledge integration, knowledge use, and Knowledge Management itself.

Conclusion: The Open Enterprise and Other Issues

In explaining how to bridge knowledge gaps, I've enumerated a number of initiatives that Knowledge Managers, or Knowledge Management considered as an organizational function, could take to enhancing problem recognition, generating new ideas, and eliminating errors in these new ideas, as well as old ones. I've also offered these in an optimistic tone and with an implication that if you take these initiatives you will, indeed, enhance your capability to bridge knowledge gaps and solve problems. Now here come the cautions and qualifications.

This set of initiatives for bridging knowledge gaps isn't complete for two reasons. First, I've certainly made some errors of omission. But, second, space limitations required that I not cover a number of promising interventions in the categories I discussed above.

Further, when you evaluate my proposals, you can look at them individually or look at them more holistically as a pattern. If you read Knowledge Management Magazine regularly, you'll remember my collaborator Mark McElroy's article in the September 2002 issue, which introduced the idea of "The Open Enterprise." The holistic view I'm proposing here is a series of interrelated proposals that together amount to an effort to establish "openness" in Problem Recognition, Knowledge Claim Formulation and Knowledge Claim Evaluation, and in that way move towards The Open Enterprise pattern of organization, a pattern optimized for innovation and corporate transparency. But getting to The Open Enterprise is not as simple as instituting a particular set of programs and policies.

Organizations are complex adaptive systems, subject both to management interventions, and to self-organization at every level of organizational interaction including the level of the individual. The state of the organizational system emerges from the interaction of its management and self-organizing behavior and predispositions. The number of states (a system state is given by the values of and relations among the attributes of a system within a time-slice) of any organizational system is theoretically infinite. But, when we view real organizations as systems in a phase space defined by their attributes, we believe that they do not constantly change their state. Instead they stabilize in self-reinforcing patterns. We refer to these patterns as attractor basins in phase space. The Theory of the Open Enterprise conjectures that there are four important attractor basins associated with types of knowledge processing patterns.

The Politics of Openness in Knowledge Processing is one of these attractor basins, the one associated with the Open Enterprise. To get to the Open Enterprise from one of the three other attractor basins (which I will not provide an account of here), the policies and programs of Knowledge Managers can, at best, enable or empower transitions. But they can't determine them due to the emergent character of the patterns and their dependence on self-organizing interactions that managerial policies and programs can influence but not control.

So, the initiatives I've suggested above will not necessarily produce the intended effects in enhancing your capability to bridge knowledge gaps because they may run afoul of the self-organizing tendencies of the existing patterns. The chances of them having their intended effect will be greater if they are initiated:

(1) as part of a pattern of change initiatives that are synchronized with self-organizing tendencies supporting the transition to the Politics of Openness in Knowledge Processing (the Policy Synchronization Method™), rather than piecemeal;

(2) as part of an organizational pattern whose attributes (such as a moderate level of trust among individuals) provide fertile ground for these initiatives in that they enable them to reinforce one another; and/or

(3) in an organization that is already moving towards the Politics of Openness.

To summarize, we bridge knowledge gaps when we solve problems. To increase our capacities to solve problems, however, we need to enhance our problem recognition, idea generation, and error elimination capabilities. For much of this article, I've presented a "laundry list" of initiatives for enhancing the above capabilities. My list however, was not ad hoc. It focused on interventions that might be expected to increase openness in knowledge processing in the enterprise, and to move organizations toward the Open Enterprise, a type of organization characterized by enhanced capability to bridge knowledge gaps (solve problems, innovate), and greater organizational transparency. But if one wants to travel to the Open Enterprise, the way to get there is not simply a matter of implementing one or a few of the interventions presented. Instead, it is to develop a pattern of interventions that is synchronized with the tendencies toward self-organization characterizing the transition to the Open Enterprise, or to implement interventions in an organization that is ready for the transition, or is already on the road to the Open Enterprise.

In short, though enhancing the capability to bridge knowledge gaps is fundamental to an organization's ability to cope with its continuing challenges, it is not an easy thing to achieve. It can be done piecemeal with the risk that intended impacts will be negated by pre-existing patterns, or it can be done more comprehensively, but in such a way that it works against pre-existing patterns, or it can be done more comprehensively with the intent of synchronizing with self-organizing tendencies. This last choice is of course the road to travel, provided we can see it clearly.

End Notes

[1] A condensed version of this paper was published in the April 2003 issue of *Knowledge Management,* ***6, no. 7, 20-24.***

[2] In our various presentations of the KLC, Mark McElroy and I break out information acquisition as a distinct process in the KLC. In the interests of brevity I've discussed it in the context of thinking up new ideas, developing tentative solutions, or knowledge claim formulation.

[3] I know that various vendors and writers claim that Enterprise Knowledge Portals already exist. But these claims may be traced to an arbitrary choice to use the term Enterprise Knowledge Portal to describe portals whose connection to Knowledge Production, Integration, and Management is vague at best. You can test the accuracy of this claim yourself by reviewing books, articles, and vendor literature on EKPs and noting the EKP definitions and/or specifications found in these publications. Then ask yourself the following questions: Does this definition/specification imply a coherent distinction between information and knowledge? Does it imply a distinction between Information and Knowledge Portals? Does it imply portal support for KM activities? If the answers to these questions are no, the author is using the term EKP for its halo effect and the product is an Information and not a knowledge portal.

[4] Chapters 5-11 provide a foundation for the concept, and Chapters 14-17, while surveying and evaluating EIP products, make the case that there are no EKPs.

[5] Keith Holyoak and Paul Thagard have a great discussion of the nature and use of analogy in their *Mental Leaps*, Cambridge, MA: MIT Press, 1995.