Why Information Technology Inspired But Cannot Deliver Knowledge Management

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"Knowledge is experience. Everything else is just information." —Albert Einstein

A few years ago British Petroleum placed a full-page ad in the *London Times* announcing that it learned a key technology for deep-sea oil exploration from its partnership with Shell Oil Company in the Gulf of Mexico and was beginning deep-sea exploration on its own, west of the Shetland Islands. British Petroleum's ability to leverage knowledge is key to its competitive strategy. Rather than conducting its own basic research, British Petroleum learns from its partners and quickly spreads that knowledge through the company. It does this not by building a large electronic library of best practices, but by connecting people so they can think together.

Information technology has led many companies to imagine a new world of leveraged knowledge. E-mail and the Internet have made it possible for professionals to draw on the latest thinking of their peers no matter where they are located. A chemist in Minnesota can instantly tap all his company's research on a compound. A geologist can compare data on an oil field to similar fields across the globe to assess its commercial potential. An engineer can compare operational data on machine performance with data from a dozen other plants to find patterns of performance problems. As a result, many companies are rethinking how work gets done, linking people through electronic media so they can leverage each other's knowledge. A consulting company set up a best practices database with detailed descriptions of projects so consultants around the globe could draw from each other's experience. A computer company's systems design group created an electronic library of system configurations so designers could draw from a store of pre-developed components. These companies believe that if they could get people to simply document their insights and draw on each other's

work, they could create a web of global knowledge that would enable their staff to work with greater effectiveness and efficiency.

While information technology has inspired this vision, it itself cannot bring the vision into being. Most companies soon find that leveraging knowledge is very hard to achieve. Several years ago Texaco's Information Technology group installed Lotus Notes, hoping it would lead to more collaboration. They soon discovered that they only used Notes for e-mail. Not until they found an urgent need to collaborate and changed the way they worked together, did they use Notes effectively. Studies show that information technology usually reinforces an organization's norms about documenting, sharing information, and using the ideas of others. People send most e-mail to those they work with daily. Computer mediated interaction is usually more polite than face-to-face, despite occasional flaming. Computer-aided decision making is no more democratic than face-to-face decision making. Virtual teams need to build a relationship, often through face-to-face meetings, *before* they can effectively collaborate electronically.[1] The difficulty in most knowledge management effort lies in changing organizational culture and people's work habits. It lies in getting people to take the time to articulate and share the really good stuff. If a group of people don't already share knowledge, don't already have plenty of contact, don't already understand what insights and information will be useful to each other, information technology is not likely to create it. However, most knowledge management efforts treat these cultural issues as secondary, implementation issues. They typically focus on information systems—identifying what information to capture, constructing taxonomies for organizing information, determining access, and so on. ***The great trap in knowledge management is using information management tools and concepts to design knowledge management systems.***

Creating Information Junkyards

A good example of how information technology alone cannot increase the leverage of professional knowledge comes from a large consumer products company. As part of reorganization, the company decided to improve professional work. Professional staff were instructed to document their key work processes in an electronic database. It was a hated task. Most staff felt their work was too varied to capture in a set of procedures. But after much berating by senior managers about being "disciplined," they completed the task. Within a year the database was populated, but little used. Most people found it too general and generic to be useful. The help they needed to improve their work processes and share learning was not contained in it. The result was an expensive and useless information junkyard. Creating an information system without understanding what knowledge professionals needed, or the form and level of detail they needed, did little to leverage knowledge.

Knowledge is different from information and sharing it requires a different set of concepts and tools. Six characteristics of knowledge distinguish it from information:

- Knowing is a human act
- Knowledge is the residue of thinking
- Knowledge is created in the present moment
- Knowledge belongs to communities
- Knowledge circulates through communities in many ways
- New knowledge is created at the boundaries of old

Leveraging knowledge involves a unique combination of human and information systems.

Knowing, Thinking, and Community

Knowing is a human act. Discussions of knowledge management often begin with definitions of data, information, and knowledge. I would like to take a different starting point: an inquiry into our own experience using, discovering, and sharing knowledge. By reflecting on our own individual experience, we can gain a deeper understanding of the nature of knowledge and how we and *others* use it.[2] As Maurice Merleau-Ponty observed, "We arrive at the universal, not by abandoning our individuality, but by turning it into a way of reaching out to others."[3]

Reflecting on our experience, the first thing that comes into view is that *we* know. Knowledge always involves a person who knows. My bookcase contains a lot of information on organizational change, but we would not say that it is knowledgeable about the subject. The same is true for my computer, even though it can store, sort, and organize information much more quickly than my bookcase. Thinking of our minds as a biochemical library is little different from treating it as a bookcase or computer. To know a topic or a discipline is not just to possess information about it. It is the very human ability to *use* that information.

The art of professional practice is to turn information into solutions. To know a city is to know its streets, not as a list of street names or a map, but as a set of sights and routes useful for different *purposes*. Driving through your hometown to avoid rush-hour traffic, find an interesting restaurant, bring relatives sightseeing, or go bargain hunting, you not only draw on a vast amount of information, you *use* the information in different ways. Your purpose determines the information you focus on and remember, the routes that come to mind. Professionals do the same thing. They face a stream of problems; when to run a product promotion, how to estimate the size of an oil field, how to reduce the weight and cost of a structure. To solve these problems, professionals *piece information*

together, reflect on their experience, *generate* insights, and *use* those insights to *solve* problems.

Thinking is at the heart of professional practice. If we look at our own experience, *thinking* is key to making information useful. Thinking transforms information into insights and insights into solutions. When jamming, jazz musicians get a feel for where the music is going, adjust to their partners' moves, change direction, and readjust. They take in information, make sense of it, generate new musical ideas, and apply their insights to the ongoing musical conversation. Responding to each other, they draw on tunes, chords, progressions, and musical "feels" they have known before, even though at any moment they could not predict "what's next." Jamming is a kind of musical thinking.[4] Science, architecture, engineering, marketing, and other practical professions are not that different. Professionals do not just cut and paste "best practice" from the past to the current situation. They draw from their experience to *think about* a problem. An architect looking for a design that will work on a steeply sloping site, looks at the site "through the eyes" of one idea, discards it and sees it again "through the eyes" of a different idea, drawing on different information about the site in each thought experiment. In running these experiments, the architect is not just looking for pre-made solutions, but thinking about how those solutions might apply and letting ideas *seep* from one framework to the next, so a new, creative idea can emerge.[5] Professional practice is also a kind of improvisation within a territory, whether that's a keyboard, a science, or a computer application. As knowledgeable practitioners, we move around the territory, sometimes with accuracy and efficiency, sometimes with grace and inspiration. A group of systems designers for a computer company tried to leverage their knowledge by storing their system documentation in a common database. They soon discovered that they did not need each other's system documentation. They needed to understand the logic other system designers used—why *that* software, with *that* hardware and *that* type of service plan. They needed to know the path of thinking other system designers took through the field. *To know a field or a discipline is to be able to think within its territory.*

Knowledge is the residue of thinking. Knowledge comes from experience. However, it is not just raw experience. It comes from experience that we have reflected on, made sense of, tested against other's experience. It is experience that is *informed by* theory, facts, and understanding. It is experience we make sense of in relationship to a field or discipline. Knowledge is what we retain as a result of thinking through a problem, what we remember from the route of thinking we took through the field. While developing a report on a competitor, a researcher deepens her understanding of her research question, the competitor, and the information sources she used, particularly if she used a new question, source, or approach. *From the point of view of the person who knows, knowledge is a kind of sticky residue of insight about using information and experience to think.*

Knowledge is always *recreated* in the present moment. Most of us cannot articulate what we know. It is largely invisible and often comes to mind only

when we need it to answer a question or solve a problem. This isn't because knowledge is hard to find in our memory. It is because knowledge resides in our body. To find it we don't search. We engage in an act of knowing.[6] Knowledge is what a lathe operator has in his hands about the feel of the work after turning hundreds of blocks of wood. Knowledge is the insight an engineer has in the back of her mind about which analytic tools work well together and when to use them. To use our knowledge we need to make sense of our experience again, here in the present. When I think through how to champion an organizational change, I draw from the constantly evolving landscape of what I know now about change, my evolving "mental models" of change. I put that insight together in a new sense, one created just here and now. Sometimes it includes new insights freshly made. Sometimes it forgets old ones. Learning from past experience, sharing insights, or even sharing "best practices" is always rooted in the present application, the thinking we are doing now. *Insights from the past are always mediated by the present, living act of knowing.*[7]

To share knowledge we need to *think about* the present. Sharing knowledge involves guiding someone through our thinking or using our insights to help them see their own situation better. To do this we need to know something about those who will use our insights, the problems they are trying to solve, the level of detail they need, maybe even the style of thinking they use. For example, novices frequently solve problems by following step-by-step procedures, but experts solve problems in an entirely different way. They typically develop a theory of potential causes based on their experience and test to see if the theory

Playing "Give Me Your Best Line"

Years ago a geoscientist at Shell Oil Company who had an uncanny knack for finding oil, initiated an odd lunch-time game. Geoscientists explore prospective sites using seismic data, which give a two dimensional picture of the earth, like the side of a slice of cake. The more lines of seismic data, the more complete and three-dimensional the picture of the prospect. His game was to gather a group of geoscientists and guess at the structure of the prospect, using the fewest number of seismic lines, and therefore the least amount of information possible. Since a prospect's geology is key to finding oil, the game had serious practical consequences. This game caused people to think together about the prospect. With very little data, it was easy to pose different theories, challenge assumptions, and reformulate their ideas. The lack of data encouraged them to consider a wider variety of models of the geography than they would have with more complete data. As they collected more data about the prospect, they continued the game and discovered which theories had been correct. The game was a powerful exercise in leveraging knowledge. It enabled this group to share their thinking and reformulate their assumptions as they expanded their understanding.

is correct, often testing the least complex or expensive theories, rather than the logically correct ones, first.[8] The knowledge useful to novices is very different from the knowledge useful to experienced practitioners. Sharing knowledge is *an act of knowing* who will use it and for what purpose. For peers, this often involves mutually discovering which insights from the past are relevant in the present. To document for a general audience, like writing a textbook, also involves imagining a user, the novice. It is our picture of the user—their needs and competencies—that determines the level of detail, tone and focus of the insights we share.

Knowledge belongs to *communities*. The idea that knowledge is the stuff "between the ears of the individual" is a myth. We don't learn on our own. We are born into a world already *full* of knowledge, a world that already makes sense to other people—our parents, neighbors, church members, community, country. We learn by participating in these communities and come to embody the ideas, perspective, prejudices, language, and practices of that community.[9] The same is true for learning a craft or discipline. When we learn a discipline, whether at school or on the job, we learn more than facts, ideas, and techniques. We enter a territory already occupied by others and learn by participating with them in the language of that discipline and seeing the world through its distinctions. We learn a way of thinking. Marketing specialists learn market survey methods; but they also learn a marketing perspective. They learn to ask questions about product use, customer demographics, lifestyle, product life cycles, and so forth. This perspective is embedded in the discipline and handed down through generations of practitioners. It is part of the background knowledge and accumulated wisdom of the discipline. Architects from different schools approach problems in characteristically different ways. Each school's approach is embedded in the everyday practices of its faculty, shared as they see the logic of each other's thinking. *Knowledge flows through professional communities, from one generation to the next.* Even though we do most of our thinking alone, in our office or study, we are building on the thinking of others and to contribute to a discipline, we must put our ideas out into the "public"—just stewards for a moment. Even when we develop ideas that contradict the inherited wisdom of the profession, our "revolutionary" ideas are meaningful only in relation to the community's beliefs. They are still a form of participation in that discipline.[10] Despite changes in membership and dominant paradigms, the discipline itself continues often with its basic assumptions and approaches relatively intact for generations.

Knowledge circulates through communities in many ways. We typically think of a community's knowledge as the stuff in textbooks, articles, written procedures, individual file cabinets, and people's minds. However, many other "objects" contain a community's knowledge: unwritten work routines, tools, work products, machinery, the layout of a workspace or tools on a tray, stories, specialized language, and common wisdom about cause-effect relationships.[12] These unwritten artifacts circulate through the community in many ways.

Thinking With Information at the Center for Molecular Genetics

Researchers at the Center for Molecular Genetics in Heidelberg use photographs extensively in their work. They take pictures of radioactively marked DNA and RNA strands using X-ray film. Their challenge is to make sense of these pictures, interpreting what the markings on the film indicate about the structure of the material and its implications for their experiments. As they pull photos from the darkroom, other people in the lab gather around to discuss what they see. These discussions frequently refer to other research, both published and current. They see the film through the eyes of one set of research findings, then another. Through these informal gatherings, the researchers think aloud together, challenge each other, try dead ends, draw metaphors from other disciplines, and use visual models and metaphors to make sense of their data and reach conclusions. Their collective know-how and knowledge of the research literature are the living backdrop for these discussions. Sometimes they talk through a procedure, looking for the meaning of a result in its minute details. Other times they focus on research findings, letting their procedures fade into the background as they compare their results to others. In these discussions, they use their knowledge of the literature and their lab know-how to think about and solve the current research problem.[11]

Stories are told at conferences and chance hallway meetings. People see each other's thinking as they solve problems together, in peer reviews, or in notes in the margins of work products. People observe and discuss informal work routines in the everyday course of work. So where does a community's knowledge reside? From the practitioner's perspective, only a small percentage is written. Most is in these informal, undocumented practices and artifacts. All contacts within the community can be vehicles for sharing knowledge, even though most are not intended to be. As Wallace Stevens wrote, "Thought is an infection, some thoughts are an epidemic."

New knowledge is created at the boundaries of old. If you reflect on how you learn new things, you probably find that most of the time you learn by comparing the new idea, fact, or tool to ones you already know. The everyday practice of professional work involves thinking that draws from experience and current information. But new knowledge typically does not come from thinking within the ordinary bounds of a discipline or craft. It comes from thinking at the edge of current practice. New, disruptive technology is often developed by small companies at the edge of a marketplace.[13] Scientists are frequently most productive a few years after they have crossed over from one specialty to another. New ideas in science frequently emerge, not from paradigm shifts at the heart of the discipline, but when scientists run out of interesting research questions—and

publication opportunities—at the heart of their discipline and either shift to subspecialties on the margin of the discipline or combine the perspectives of different disciplines, forming new specialties such as psychopharmachology.[14] *New ideas emerge in the conflict of perspective, the clash of disciplines, the murky waters at the edge of a science, the technology that doesn't quite work, on the boundaries of old knowledge.*

In summary, when we look at our own experience, knowledge is much more—and much more elusive—than most definitions allow. Knowing is a *human act,* whereas information is an *object* that can be filed, stored, and moved around. Knowledge is a *product of thinking,* created in the *present moment,* whereas information is fully made and can sit in storage. To share knowledge, we need to *think about the current situation,* whereas we can simply move information from one mailbox to another. *However, knowledge is more than you think.* Knowledge settles into our body. It is a kind of "under the fingernails" wisdom, the background know-how from which we draw. Most of us find it hard or impossible to articulate what we know; whereas information can be written or built into machinery. We acquire knowledge by participating in a community—using the tools, ideas, techniques, and unwritten artifacts of that community; whereas we acquire information by reading, observing, or otherwise absorbing it. *Ironically, when we look at our experience, the heart of knowledge is not the great body of stuff we learn, not even what the individual thinks, but a community in discourse, sharing ideas.*

Implications for Leveraging Knowledge

What are the implications of these philosophical reflections on the movement to manage knowledge? Clearly, leveraging knowledge involves much more than it seems. It is not surprising that documenting procedures, linking people electronically, or creating web sites is often not enough to get people to think together, share insights they didn't know they had, or generate new knowledge. Using our own experience as a starting point to design knowledge management systems leads to a different set of design questions. Rather than identifying information needs and tools, we identify the community that cares about a topic and then enhance their ability to think together, stay in touch with each other, share ideas with each other, and connect with other communities. *Ironically, to leverage knowledge we need to focus on the community that owns it and the people who use it, not the knowledge itself.*

To Leverage Knowledge, Develop Existing Communities

Develop natural knowledge communities without formalizing them. Most organizations are laced with communities in which people share knowledge, help each other, and form opinions and judgments. *Increasing an organization's ability to leverage knowledge typically involves finding, nurturing, and supporting the communities that already share knowledge about key topics.* Allied Signal supports learning communities by giving staff time to attend community meetings,

Implications for Leveraging Knowledge

1. *To leverage knowledge, develop communities.*
2. *Focus on knowledge important to both the business and the people.*
3. *Create forums for thinking as well as systems for sharing information.*
4. *Let the community decide what to share and how to share it.*
5. *Create a community support structure.*
6. *Use the community's terms for organizing knowledge.*
7. *Integrate sharing knowledge into the natural flow of work.*
8. *Treat culture change as a community issue.*

funding community events, creating community bulletins, and developing a directory of employee skills. If too formalized, learning communities can become bureaucratic structures, keepers of the discipline's "official story" that act as approval hurdles for operations groups. The key to nurturing communities is to tap their natural energy to share knowledge, build on the processes and systems they already use, and enhance the role of natural leaders.

Focus on Knowledge Important to Both the Business and the People

Learning communities are organized around important topics. Developing communities takes considerable effort. The best way to insure that the effort is well spent is to identify topics where leveraging knowledge will provide value to the business as well as community members. People naturally seek help, share insights, and build knowledge in areas they care about. At Chaparral Steel, blue-collar employees meet with customers, solve problems, create new alloys, and continually redesign the steel-making process. They share insights with each other as they search for innovative, cost-competitive solutions to customer needs. Sharing knowledge helps staff solve problems directly related to their day-to-day work.[15] *Natural learning communities focus on topics that people feel passionate about.* In Shell's Deepwater Division, most learning communities are formed around disciplines, like geology, or topics that present new challenges to the business or their field. They are topics people need to think about to do their work. Most are topics people have studied, find intrinsically interesting, and have become skillful at moving around in. As one geologist said, "With so many meetings that aren't immediately relevant to your work, it's nice to go to one where we talk about rocks."

Create Forums for Thinking and Sharing Information

The ways to share knowledge should be as multidimensional as knowledge itself. Most corporate knowledge sharing efforts revolve around tools,

typically electronic ones. The company finds a tool, or develops one, and then finds groups to use it. This may be good for sharing information, but since *knowing involves thinking about a field full of information*, a *knowledge management* system should include both systems for sharing information and forums for thinking. To paraphrase Henry Adams, facts without thinking are dead, and thinking without facts is pure fantasy.[16] The field of information can include statistics, maps, procedures, analyses, lessons learned, and other information with a long shelf life, but it can also include interpretations, half-formed judgements, ideas, and other perishable insights that are highly dependent on the context in which they were formed. The forums, whether face-to-face, telephone, electronic, or written, need to spark collaborative thinking not just make static presentations of ideas. In Shell's Deepwater Division, most learning communities hold regular collaborative problem-solving meetings facilitated by a community coordinator. These sessions have two purposes. First, by solving real day-to-day problems, community members help each other and build trust. Second, by solving problems in a public forum, they create a common understanding of tools, approaches, and solutions. One learning community in Shell, composed mostly of geologists, asks people to bring in paper maps and analyses. During the meetings, people literally huddle around the documents to discuss problems and ideas. The community coordinator encourages community members to make their assumptions visible. The combination of information and thinking leads to a rich discussion. While they discuss the issues, someone types notes on a laptop, so key points are captured. This community's process for leveraging knowledge includes thinking and information, human contact and IT. In the course of problem-solving discussions such as these, most communities discover areas where they need to create common standards or guidelines, commission a small group to develop them, and incorporate their recommendations. Most have a web site where they post meeting notes and guidelines. Some have even more elaborate community libraries.

Let the Community Decide What to Share and How to Share It

Knowledge needs to have an "owner" who cares. It is tempting to create organization-wide systems for sharing knowledge so everyone can access it. This can be useful if all members of the organization truly need to work with that body of knowledge, but the further away you get from community's actual needs, the less useful the information. Communities vary greatly in the kind of knowledge they need to share. In Shell's Deepwater Division, operations groups need common standards to reduce redundancy and insure technology transfer between oil platforms. Their learning communities focus on developing, maintaining and sharing standards. Geologists, on the other hand, need to help each other approach technical problems from different directions to find new solutions. They need to understand the logic behind each other's interpretations. Another community found they were each collecting exactly the same information from external sources, literally replicating each other's work. They needed

Many Forums for Discussing Petrophysics

A division of a Shell Oil Company recently organized its professional engineers into permanent cross-functional teams. Team members are located together and some engineering disciplines have only one member on the team. Once organized into this new structure, a group of petrophysicists realized how much they needed other members of their discipline to get advice and think through issues. In the past they just walked down the hall to get help, they now needed to go several floors away to find a peer.

So they decided to create a process for sharing knowledge with each other that crosses the boundaries of the operations teams. Some parts of this system are organic, some informal, some explicit, and some formal. For consulting each other on interpretations of data, they hold informal, agenda-less weekly meetings where anyone can get input on any topic. These are different from most agenda-driven meetings in that they emphasize open dialogue for exploring issues, with no pressure to come to resolution. To share knowledge that is more explicit, they have formal presentations on new technology. To ensure their data is consistent and widely available, they opened a common electronic data library that lets them compare data from many different sites. To ensure that informal help is available at any time, they established a senior coordinator who facilitates interaction among members of the discipline as well as provides his own insights and answers. Each of these forums is useful for sharing a different kind of knowledge, from fuzzy know-how to concrete data. Having all of them available ensures that each is used for sharing the knowledge most appropriate to it.

a common library and someone responsible for document management. Since information is meaningful only to the community that uses it, the community itself needs to determine the balance of how much they need to think together, collect and organize common information, or generate standards. Since knowledge includes both information and thinking, only the community can keep that information up-to-date, rich, alive, available to community members at just the right time, and useful. Only community members can understand what parts of it are important. When communities determine what they need to share and what forum will best enable them to share it, they can more readily own both the knowledge and the forums for sharing it.

Create a Community Support Structure

Communities are held together by people who care about the community. In most natural communities, an individual or small group takes on the job of holding the community together, keeping people informed of what others are doing and creating opportunities for people to get together to share ideas. In

intentional communities, this role is also critical to the community's survival, but it typically needs to be designed. Community coordinators are usually a well-respected member of the community. Their primary role is to keep the community alive, connecting members with each other, helping the community focus on important issues, and bringing in new ideas when the community starts to lose energy. In Allen's study, project engineers used information from technical consultants and suppliers more readily when it was funneled through an internal gatekeeper than when the consultants met with them directly.[17]

Use information technology to support communities. Most companies use information technology to support individual work, leaving it to each individual to sort through the information that comes their way, decide what is important, clean, and organize it. However, if communities own knowledge, then the community can organize, maintain, and distribute it to members. This is another key role of community coordinators or core group members. They use their knowledge of the discipline to judge what is important, groundbreaking, and useful and to enrich information by summarizing, combining, contrasting, and integrating it. When IBM introduced its web-based Intellectual Competencies system, anyone could contribute to the knowledge base. However, like many other companies, IBM soon discovered that their staff did not want to hunt through redundant entries. Now a core group from each community organizes and evaluates entries, weeding out redundancies and highlighting particularly useful or groundbreaking work. Frequently, technical professionals see this as a "glorified librarian" role and many communities also have librarians or junior technical staff to do the more routine parts of organizing and distributing information.

Use the Community's Terms for Organizing Knowledge

Organize information naturally. Since knowledge is the sense we make of information, then the way information is organized is also a sense-making device. A good taxonomy should be intuitive for those who use it. To be "intuitive" it needs to tell the story of the key distinctions of the field, reflecting the natural way discipline members think about the field. Like the architecture of a building, a taxonomy enables people to move about within a bank of information, find familiar landmarks, use standard ways to get to key information, create their own "cowpaths," and browse for related items. This is a common way to spark insight. Of course, this means that if you have multiple communities in an organization, they are likely to have different taxonomies, not only in the key categories through which information is organized, but also in the way that information is presented. A group of geologists, who often work with maps, asked that their web site for organizing information be a kind of visual picture. They think in pictures. However, a group of engineers in the same organization wanted their web site to be organized like a spreadsheet. They think in tables. *The key to making information easy to find is to organize it according to a scheme that tells a story about the discipline in the language of the discipline.*

How standard should company taxonomies be? Only as wide as the community of real users. There is a great temptation to make all systems for organizing knowledge the same. Certainly formatting information so it can easily be transferred—having the same metadata so it can be searched, indexed, and used in different contexts—can be very useful. However, beyond that the systems for organizing information should be the community's. If a community of people sharing knowledge spans several disciplines, then such things as terms and structures should be common among those communities.

Integrate Learning Communities into the Natural Flow of Work

Community members need to connect in many ways. Because communities create knowledge in the present moment, they need frequent enough contact to find commonality in the problems they face, see the value of each other's ideas, build trust, and create a common etiquette or set of norms on how to interact. When people work together or sit close enough to interact daily, they naturally build this connection. It simply emerges from their regular contact. When developing intentional learning communities, it is tempting to focus on their "official tasks;" developing standards, organizing information, or solving cross-cutting technical problems. However, it is also important for them to have enough open time for "technical schmoozing," sharing immediate work problems or successes, helping each other, just as they would if they were informally networking down the hall. This informal connection is most useful if it can happen in the spontaneous flow of people's work as they encounter problems or develop ideas. So community members need many opportunities to talk one-on-one or in small groups on the telephone, through e-mail, face to face, or through an Internet site. In Shell's Deepwater Division, community coordinators "walk the halls," finding out what people are working on, where they are having problems, and making connections to other community members. This informal connecting ensures that issues don't wait until community meetings to get discussed and keeps other channels of communication open.

Treat Culture Change as a Community Issue

Communities spread cultural change. Failures in implementing knowledge management systems are often blamed on the organization's culture. It is argued that people were unwilling to share their ideas or take the time to document their insights. However, organizational culture is hard to change. It rarely yields to efforts to change it directly by manipulation of rewards, policies, or organizational structure. Often it changes more by contagion than decree. People ask trusted peers for advice, teach newcomers, listen to discussions between experts, and form judgments in conversations. In the course of that connection with community members, they adopt new practices. Despite massive efforts by public health organizations to educate physicians, most physicians abandon old drugs and adapt new ones only after a colleague has personally recommended it. They rely on the *judgement* of their peers—as well as the information they get

from them—to decide. New medical practices spread through the medical community like infectious diseases, through individual physician contact. Learning communities thrive in a culture that supports sharing knowledge. However, they are also vehicles for creating a culture of sharing. While it is important to align measurement, policies, and rewards to support sharing knowledge,[18] the key driver of a change toward sharing knowledge is likely to be within communities.[19]

Conclusion

Today, the "knowledge revolution" is upon us, but the heart of this revolution is not the electronic links common in every office. Ironically, while the knowledge revolution is inspired by new information systems, it takes human systems to realize it. This is not because people are reluctant to use information technology. It is because knowledge involves thinking with information. If all we do is increase the circulation of information, we have only addressed one of the components of knowledge. To leverage knowledge we need to enhance both thinking and information. The most natural way to do this is to build communities that cross teams, disciplines, time, space, and business units.

There are four key challenges in building these communities. The *technical challenge* is to design human and information systems that not only make information available, but help community members think together. The *social challenge* is to develop communities that share knowledge and still maintain enough diversity of thought to encourage thinking rather than sophisticated copying. The *management challenge* is to create an environment that truly values sharing knowledge. The *personal challenge* is to be open to the ideas of others, willing to share ideas, and maintain a thirst for new knowledge.

By combining human and information systems, organizations can build a capacity for learning broader than the learning of any of the individuals within it.

Notes

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2. This is the starting point philosophical inquiry. See Husserl and Merleau-Ponty on the importance of founding scientific theory on philosophical inquiry. Edmund

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