

Evolving communities of practice: IBM Global Services experience

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In 1995, IBM Global Services began implementing a business model that included support for the growth and development of communities of practice focused on the competencies of the organization. This paper describes our experience working with these communities over a five-year period, concentrating specifically on how the communities evolved. We present an evolution model based on observing over 60 communities, and we discuss the evolution in terms of people and organization behavior, supporting processes, and enabling technology factors. Also described are specific scenarios of communities within IBM Global Services at various stages of evolution.

Considerable attention is being focused on communities¹ as an important element in the life of an organization. Driven by a knowledge economy, organizations need their employees to become “knowledge workers,” that is, individuals who constantly draw on a wealth of knowledge to devise new responses and solutions for a rapidly changing marketplace. To perform well in this knowledge economy, individuals must constantly apply and add to their own bodies of knowledge. They do this by finding ways to participate on a day-to-day basis in a flow of knowledge that consists, not only of the dissemination of data and printed material, but also of the exchange of ideas with other individuals who have experience and skill related to the same area of work. This interaction with others on work-related topics often leads naturally to the formation of communities of practice. In addition, as “. . . companies are beginning to recognize that these communities can be supported and leveraged to benefit the ‘membership’ of communities and the organization as a

whole,”² they are starting to sponsor the formation of communities and to support their ongoing activity.

Our concept of a community of practice comes from the work of Wenger and Snyder who define it as “a group of people informally bound together by shared expertise and passion for a joint enterprise,”³ or similarly, as a collection of individuals bound by informal relationships that share similar work roles and a common context.⁴ Examples of communities of practice are found in many organizations and have been called by different names at various times, names such as “learning communities” at Hewlett-Packard Company, “family groups” at Xerox Corporation, “thematic groups” at the World Bank, “peer groups” at British Petroleum, p.l.c., and “knowledge networks” at IBM Global Services, but they remain similar in general intent.

As organizations start to recognize the role of communities of practice in helping them meet their business needs and objectives, efforts to better understand the workings of these communities have emerged. Knowledge-management-related conferences routinely include communities as a key agenda topic.⁵ Organizations, like those mentioned above, support and report on the formation and ongoing maintenance of communities, recognizing the influ-

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ence they have in helping the organizations to be productive and innovative.

One such organization is IBM Global Services,⁶ which established a knowledge management program⁷ in 1995 that depended heavily on forming and developing communities of practice to benefit both the individual and the organization. In this paper, we first look at the overall program and the types of communities that emerged within the context of this program. Then we describe a general model for how these communities of practice evolved and explore the model further in terms of people, process, and technology differences and implications that emerge at each stage of evolution. We provide specific scenarios of communities of practice, showing how they started and then progressed to a particular stage in the evolution model. Finally, we share what we learned about community development and conclude with some possibilities and questions related to the evolution of communities in a business environment.

Communities of practice within IBM Global Services

The communities of practice, commonly called “knowledge networks,” are referred to as institutionalized, informal networks of professionals managing domains of knowledge. The common characteristics of and guidelines for forming a knowledge network are:

- They are global in scope, connecting practitioners worldwide and fostering a sense of community.
- They are responsible for a domain of knowledge. This responsibility includes:
 - Handling explicit knowledge⁸ or intellectual capital;⁹ handling means gathering, evaluating, structuring, and disseminating knowledge that is shared among community peers and across customer projects and seeing to its evolution. The intellectual capital consists of methods, processes, tools, assets, reported experiences, and any other documentation associated with delivering services and considered of value by the business or community.
 - Adopting a small set of common roles¹⁰ for managing knowledge
 - Providing opportunities for sharing tacit knowledge¹¹ among community members
 - Using the common enterprise-wide Lotus

Notes** and Domino** application called ICM (intellectual capital management) AssetWeb¹²

- They are sponsored by a business unit and fostered where the business sees a need for managing knowledge for its core competencies or to meet customer or market demands.
- They are neither organization units nor teams.

The domains of knowledge represented by these communities range from *IBM core competencies* (such as enterprise systems management, application de-

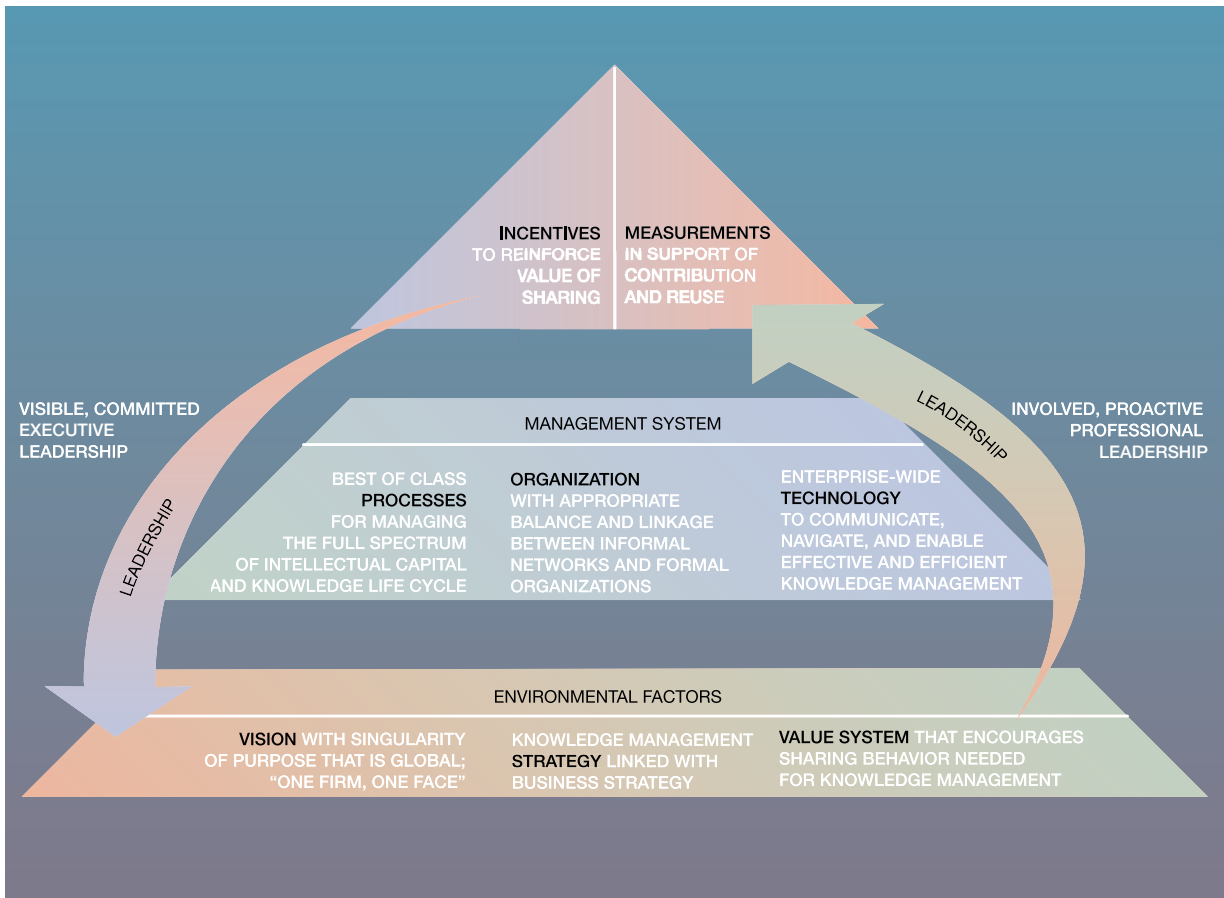
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velopment, testing methods and practices, product platform, and organization change) to “*go to market*” competencies (such as e-business, package integration, total systems management, mergers and acquisitions, and knowledge management) to *industry sector competencies* (such as automotive, chemicals and petroleum, distribution, finance and insurance, and health care).

Today there are over 60 knowledge network communities with members from virtually every country that IBM serves. By the end of the year 2000, over 76000 professionals had access to the ICM AssetWeb application and about 20000 participated in some form of community activity. Many of these knowledge networks have existed for multiple years. This participation level and sustainability are indicators that the approach developed and used by IBM Global Services has a significant degree of success.

All of these communities evolved with some assistance from the knowledge management program specialists, tools, and processes. However, the level of assistance varied widely. If the business identified a need for a knowledge network, the sponsor or leaders instigated its formation with the help of the specialists. Sometimes, if there was an existing informal community and the business recognized the importance of supporting that community’s further develop-

Figure 1 IBM knowledge management framework



ment, it would seek the guidance of the knowledge management program. Occasionally, a community on its own sought assistance from the knowledge management group for help with its development, usually to obtain some level of organizational recognition, support, and access to the common technology infrastructure.

Organizational influences related to forming communities. Surrounding and supporting the communities are the elements of a comprehensive knowledge management framework (Figure 1) that includes: vision, business strategy, value system, measurements, incentives, processes, technology, and leadership. The framework is important because it helps link or align a community with the organization's goals, management, value system, and infrastructure. Forming a knowledge network community in IBM

Global Services depends first on identifying the strengths and weaknesses of the sponsoring organization in people, process, and technology factors related to each element of the framework, and then on forming appropriate plans to address the framework-related issues raised. Since IBM Global Services is a large, complex, global organization, the various lines of business that sponsor knowledge network communities vary widely on most of the framework elements, resulting in environmental variations for community development.

Even though the communities are affiliated with a common knowledge management program and are an integral part of the overall business model, they can and do act independently, responding to the needs of their members as well as the organizational and marketplace environments within which they re-

Table 1 Community evolution model definition

	Potential	Building	Engaged	Active	Adaptive
Definition	A community is forming.	The community defines itself and formalizes its operating principles.	The community executes and improves its processes.	The community understands and demonstrates benefits from knowledge management and the collective work of the community.	The community and its supporting organization(s) are using knowledge for competitive advantage.

side. Consequently, there is wide variability in how they “look,” talk, organize, and work, even though they have some elements in common. For example, even performing one of the basic responsibilities—managing intellectual capital in its domain of knowledge—the approach varies significantly across the communities. Some have a highly structured process; others have a “loose” workflow. Some involve only a small core of committed specialists in review of the material; others create wide-ranging networks of subject matter experts. Some cull material stringently from their knowledge bases; others loosely define what might be of importance to the community and leave much material for consideration. Some create highly detailed taxonomies; others produce a limited number of general categorizations.

Our experience of this variability among these communities, despite their links to the overall knowledge management program and to any organizational directives, coincides with and supports the observation made by Wenger:¹³

Communities of practice . . . reflect the members’ own understanding of what is important. Obviously, outside constraints or directives can influence this understanding, but even then, members develop practices that are their own response to these external influences. Even when a community’s actions conform to an external mandate, it is the community—not the mandate—that produces the practice. In this sense, communities of practice are self-organizing systems.

Gathering knowledge about the communities and applying the evolution model

A vast amount of information and data about the knowledge network community development was accumulated. The profiles of the knowledge network communities and the evolution model proposed are

outgrowths of work done over the last five years and are derived from three primary approaches. (1) Participant observation: The authors and their teammates worked directly with many of the communities to help support their formation and functioning. As such, we “lived” with the communities, participating in their meetings, conference calls, reporting, planning, and so on. Sometimes we were actively involved in facilitation, but we were always observing, sharing, and learning. (2) Activity measurements: A number of indicators having to do with the management and usage of the repository of intellectual capital of the knowledge network were tracked and reported on a monthly basis. Changes over time were analyzed and trends noted. (3) Structured interviews: On a periodic basis the leaders, executive sponsor, and a sample of members of the community were interviewed using a structured interview guide. These interviews were a “health check” to learn about overall activities and functioning of the community internally and also in relationship to its larger organizational environment.

In addition, annual strategic and operational planning data for the community-sponsoring lines of business and geographic regions were reviewed. These data provided insight into organizational recognition of, support for, and investment in knowledge network communities.

How the communities evolved in IBM Global Services. There is a pattern to how the communities evolved and the pattern is influenced by a dynamic balance of people, process, and technology elements. We observed this pattern across the range of communities regardless of the strategy and approaches to knowledge management of the sponsoring organizations. The overall evolution pattern was summarized into five stages: potential, building, engaged, active, and adaptive. (See Table 1.) Using this pattern we developed an evolution model that helped us describe those characteristics that distinguish com-

Table 2 Fundamental functions for the stages of evolution

	Potential Stage	Building Stage	Engaged Stage	Active Stage	Adaptive Stage
Fundamental Functions	Connection	Memory and context creation	Access and learning	Collaboration	Innovation and generation

munities in one stage from those in another. The model is intended to show that communities are distinct at each stage, having different characteristics as they transform from one level to another. This model also presupposes that at each latter stage, the functions and characteristics of the previous stage(s) already exist.

At first glance our community evolution model appears to be a form of life-cycle model similar to what Wenger¹³ or McDermott¹⁴ propose. Their models use a life-cycle concept to describe communities as developing through stages akin to birth, maturation, and death. Wenger sees communities of practice as progressing through five stages: potential, coalescing, active, dispersed, and memorable, with levels of interaction and types of activities varying across the stages. Members' interaction within the community generally increases through the active level and then declines through the dispersed stage, and pretty much disappears at the memorable level, although memories, stories, and artifacts of the community still remain.

McDermott views communities as living, human institutions that "form spontaneously, grow, mature, change, age and die."¹⁵ He uses this life-cycle perspective to describe five stages of community development, similar to Wenger's model but with more elaboration of the tensions and challenges that stimulate the community to develop and renew itself, but that eventually lead to the community's death. McDermott's series of stages include: plan, start-up, grow, sustain/renew, and close.

Our current evolution model is similar to Wenger's and McDermott's in recognizing formative and growth stages of development. However, the evolution model is not a life-cycle approach. In this evolution model, a community can mature and dissolve at any one of these stages beyond the initial formation level. The model describes instead how communities transform themselves, becoming more

capable at each stage, while at the same time maintaining a distinct, coherent identity throughout.

The evolution model, then, is more similar in overall intent to, for example, the capability maturity models developed by the Systems Engineering Institute for assessing software organizations¹⁶ than to the life-cycle-type development model for communities of practice, such as Wenger and McDermott describe.

Looking at the communities within IBM Global Services from the evolution model perspective, we noticed some interesting behaviors. Communities may stay at certain stages and not evolve to another level; communities may move "backward and forward" between the stages; communities may have some characteristics of one stage while they are still primarily at another stage; communities may "rest" for extended periods at one stage and suddenly evolve quickly to another stage. By grouping our observations into a capability-oriented model, we were able to describe the variations in behavior, process, and enabling technology as communities evolved.

Certain variables that are acknowledged to be important for understanding communities overall, such as the degree or intensity of participation by community members, are not discussed throughout the evolution model because they did not emerge as distinguishing features across the stages. For example, with this set of communities, participation generally showed as much variability within a stage as between stages once the community moved beyond initial formation.

Description of the stages of community evolution. Each of the five stages has its defining characteristics as well as an underlying function that helps explain why one stage is different from the next and shows what to build on from previous stages. Table 2 shows these fundamental functions at each stage of evolution.

At the first stage, the *potential stage*, a community is just starting to form. It is in a “prebirth” stage, but a nucleus begins. This nucleus is made up of individuals with something in common related to their work or interest, but the individuals have not yet discovered fully what that commonality is or how far it extends. At this potential stage, *connection* is the fundamental function. Individuals who form the nucleus must be able to locate one another, then communicate, and form relationships. A small nucleus of individuals is enough to start the process and prepare for movement to the next stage.

At the *building stage*, a community begins to coalesce and define itself. The initial members, as a group, start to define what the community is going to be and how it is going to build and declare its existence. This core group of members begins to create a structure and processes for how the community will operate, and how the members will work together over time.

At the building stage, both *context creation and memory* are fundamental functions. The core members of the community create things together, building a common understanding of what the community is and what it is not, why it is forming, and how it will function. The community then “remembers” those things, putting them to use over time. Through this process it begins a shared history. The core group of individuals building the community begins to recognize what it means to be a member of the community and can then, in turn, recognize and reach out to others—potential community members—who should belong.

During the *engaged stage* a community actually operates with a common purpose. It functions on a sustainable basis. The structure and processes designed in the previous stage are put into action. The community grows in size and complexity.

Access to one another as community members and access to what the group knows are key functions. Since the community is now running, with individuals playing their roles and executing processes, the community is *learning* a great deal about itself as an ongoing entity and also *learning* more about the environment within which it operates. It starts using what it learns to adjust and improve. At this stage, the community really begins building its capability to leverage its explicit and tacit knowledge.

At the *active stage*, a community reflects, analyzes, and really starts to understand, define, and assess the value of what it is doing and what it is contributing to its membership and to the organization. The community further extends its membership and builds relationships to other communities.

Collaboration that occurs on multiple planes is the fundamental function at the active stage. Members are working together to build and sustain the community. They are also working together to solve business problems and to exploit business opportuni-

Each of the five stages
of community evolution has
its defining characteristics
to differentiate one stage
from the next.

ties. They leverage one another and the community’s shared knowledge to perform work external to the community. Indeed, it becomes the community’s responsibility to pool knowledge and work together to address the business issues presented to it by the organization. Community members further collaborate to assess the value of what the community is doing and to publicize that value to the larger organization. Collaboration promotes an understanding throughout the larger organization of the need for and distinct benefit from the community’s knowledge and work.

At the *adaptive stage*, a community has moved to a level where it senses and responds to external conditions. It can adjust continuously to create knowledge and to establish the new structures and processes it needs for leveraging its knowledge to compete effectively and to influence—and potentially redefine—its environment. Further, the community may expand into new environments.

At this stage, the community *innovates and generates*, creating significant new business objects—new solutions, new offerings, new methods, new processes, and new groups. The community identifies, influences, and even creates trends in its area of expertise. The community’s innovation affects not just its members and the immediate domain within which

it operates but other parts of the organization and external agencies as well.

We hypothesize, however, that few communities will ever reach or sustain themselves as a community at the adaptive stage. The work being done by the community becomes too important to the organization for it to allow the community to continue as a self-governing body. There is a distinct likelihood that the organization will want more control and essentially convert the community into an organizational unit.

Through our observations and analysis we have extensive experience with communities at the first three stages and some examples of communities at the active stage, but we have minimal experience with communities at the last level, the adaptive stage. We have fragments of community experience that point to a fifth stage, but we have not seen any one community actually existing and thriving at this level. What we have seen so far is: one community with one or two aspects of the adaptive stage, and another community with another one or two aspects. In the evolution model we have projected from a combination of (1) a few communities approaching this level and manifesting some of the characteristics and (2) visions from community leaders that aspire to this stage and are actively working toward achieving it. Piecing these together has given us a profile of what the adaptive stage consists of.

The forces of people, process, and technology in community evolution. We learned that a community's evolution through these stages can be advanced or arrested, depending on the attention that a group pays to building a foundation at each developing stage. We have seen groups move forward quickly on some aspects of development and bypass others. Initially, this action may not impact the immediate performance of a community. However, if a community wants to increase its effectiveness or aspires to a more advanced evolution stage, it usually needs to return to restructure or build elements from earlier stages that it may have shortchanged.

Before describing the characteristics that we observed in the behavior of people, the degree and type of process support, and the types of technology encountered at each stage of community evolution, we should review working definitions of the scope of each element.

In talking about the behavior of *people*, we are referencing "people" in a very broad sense. We are considering people as social individuals with their individual and group behaviors, as well as the larger organizational behavior influence vis-a-vis a community.¹⁷

Processes are sets of documented steps with clearly defined roles and activities for people to perform. The knowledge network community-building processes in IBM Global Services include both internal, community-oriented processes and the external processes that are part of the larger organization. Some key processes internal to a community are: managing the community's intellectual capital, sharing tacit knowledge, communications, socialization, membership management, and content management. The external processes include incentive recognition, business strategy development and execution, and competency development. Measurement processes, a key cultural aspect of IBM, span both internally and externally oriented community processes. Within the community evolution model, we consider primarily those processes that are internal to the community.

Technology is the application of science and the body of information system knowledge that we use to fashion tools, practice knowledge arts, and extract data and information. Given the strong technical foundation of IBM Global Services, the communities used a wide range of technologies from tried-and-true tools and techniques to groundbreaking and innovative experiments.

People, process, and technology at each stage. In the following subsections, the five stages of community evolution are described as to how people, process, and technology are involved with each one.

Potential stage. We now describe the enablers for promoting connection in the potential stage listed in Table 3.

People. In order for the individuals who will become members of the potential community to connect, they must find one another, communicate, and form a link. Simple socializing behavior is required at this stage. Some key skills or competencies that helped individuals to work well in this stage include: interpersonal communication, curiosity, networking, and the ability to associate ideas.

To form a community, it is not sufficient to have individuals who may be doing the same job or existing

Table 3 Potential stage enablers that promote connection

Stage	Potential
Fundamental Function	Connection
People Behavior	Individuals find one another and link up The organization may be unaware of or uninterested in the potential community OR The organization may provide some support to locate and introduce individuals
Process Support	Identifying potential community members Locating potential community members Facilitating bringing individuals together
Enabling Technology	Electronic messaging systems: e-mail, chat rooms, lists Phone calls and teleconferences On-line forums On-line directories

in the same organizational unit. In order to connect as a community, individuals need to establish personal connections with each other. Each person looks at the others and seeks to answer the very basic question, namely: Who are you? The actual questions come out in myriad forms: What do you do? Where have you worked? What organizational unit do you report to? Do you know so-and-so? What groups are you in? And so on. All of these questions are aimed at finding out information about the other person and forming a connection. For the potential community to form, the collective answer to that question of “Who are you?” must be: “You are like me.” Additionally, each member of the nascent community must receive a reciprocal answer: Not only do I recognize that you are like me, but you recognize that I am like you in something that you value. Together we must have at least one important commonality related to our work or area of expertise that each of us recognizes.

We have seen dozens of potential communities form and dissolve without any particular organizational intervention. In fact, the organization usually does not know or care that these people are connecting. However, in some instances, the organization, motivated by a business need, becomes the catalyst for the potential community. The organization actively seeks out people to form the knowledge network community and purposefully creates introductions and potential connections among them. The organization may even create a “matchmaking” responsibility to help locate and link individuals. Such a re-

sponsibility may be part of a larger “knowledge broker” role where the broker has the responsibility to connect individuals seeking knowledge with others who have that knowledge.¹⁸

Process. The important types of processes are those that help identify and locate people who might form a community at the potential stage and those that facilitate bringing them together so that they can get to know one another. Common education and development processes, communication processes, and organization assimilation processes play an important role in connecting people. Individuals also apply their own approaches to networking, communicating, and socializing, thus allowing natural or planned communities to form.

Technology. The needs of the potential community tend to be simple: any technology that facilitates communication and places to meet and talk—whether person-to-person, person-to-group, or group-to-group—are important. Basic phone calls and conference calls, electronic mail, chat rooms, electronic messaging systems, forums, and bulletin boards, all have their place. Technology that helps identify individuals and groups according to their domains of knowledge and expertise is valuable, including tools such as on-line directories, skill and resume databases, and search engines.

Given the dispersed nature of the IBM Global Services organization, individuals who share a work-related area of expertise are located all over the world

Table 4 Building stage enablers that promote memory and context

Stage	Building
Fundamental Function	Memory and context
People Behavior	<p>Core members:</p> <ul style="list-style-type: none"> ● Learn about each other ● Share experiences and knowledge ● Build common vocabulary ● Create roles and norms ● Begin a formal history together and record it ● Start a repertoire of stories <p>The organization recognizes the community.</p>
Process Support	<p>Classifying and storing knowledge Developing ways to support the knowledge life cycle Planning for community operation Beginning deployment</p>
Enabling Technology	<p>Common repository Initial classification and categorization schema tools Document and library management systems Collaborative work environment</p>

and may not be able to find one another easily. A solid communications infrastructure and good network management are essential enablers for potential communities in this environment. Fortunately, e-business capabilities such as the intranet and Internet allow individuals to connect in ways not possible even in the recent past.

Building stage. Here we describe enablers that promote memory and context in the building stage, as listed in Table 4.

People. Individuals have to learn about one another in the work environment. They have to actually share some experiences and exchange some tacit knowledge. They must learn to talk to one another using words in the same way and build a common vocabulary and common understanding. By doing this, individuals begin to identify with all the others and, in a sense, make the decision to create a community. The key skills or competencies that helped people in this stage include: abstract thinking, organizing ability, comprehensive subject matter expertise, leadership, and the ability to create and share a vision and to develop stories.

At this stage, it is usually a small number of persons, a core group, that comes together. As in the poten-

tial stage, a fundamental question needs to be answered. The question now becomes: "Who are we?" However, it is the group rather than the individual formulating the answer. The questions related to determining the community identity include: What is our purpose? What do we know as a group? What do we do? How do we behave vis-a-vis one another? As the common identity is formed, the members begin creating a shared context, including the definition of roles and norms and the description of plans and processes for how the members will work together. Thus begins the community's history, marked usually by the emergence of stories that contribute to the early group memory.

From the organizational behavior point of view at the building stage, the organization often recognizes the identity of the community and records that it exists. If the organization is taking an active role in community formation, it will also contribute some direction in defining the community's identity and assist with the planning.

Process. At this stage, we found a number of supporting processes that are helpful. The core group may need methods that are oriented to helping them plan for the community's growth and operation, including processes to:

- Define the scope and membership for the community
- Create the roles for members to play and the norms for guiding behavior
- Determine ways in which to identify, attract, or recruit new members
- Discover what the community knows and determine how to classify and categorize that knowledge in a way that is natural for the community
- Plan for how community members will share tacit knowledge and manage explicit knowledge
- Align the enabling technology with the membership needs and supporting processes

Technology. The community needs a place to put the explicit knowledge it is accumulating so that current and future members can easily access and use it. This requirement means having a common repository that is accessible no matter where members happen to reside geographically or in what organizational unit they happen to work.

It is also helpful if the community has technological support for designing and maintaining whatever taxonomy is appropriate for its domain of knowledge. If that taxonomy support can be linked with other organizational taxonomy efforts, all the better.

Systems for managing documents and code (if code assets are part of the knowledge base) and library management are useful.

A collaborative work facility (such as Lotus QuickPlace** or TeamRoom) helps the core group to have a place to organize and share its work. Using e-meeting technology to jointly design processes and infrastructure can also be helpful during this stage.

Engaged stage. The enablers that promote access and learning in the engaged stage are listed in Table 5 and are described below.

People. The engaged stage involves individuals making a commitment to the community. They learn how to perform the defined roles. Since they are learning in the context of doing, they also build tacit knowledge about how to make the community work. These activities and interactions help individuals to develop trust in the other members and in the community as a whole. Some key skills and competencies that helped members in this stage include: teaching ability, leadership, marketing or publicity skills, ability to operationalize, multilingual and cultural proficiency, and general persistence and tenacity.

At this stage the community also expands beyond its core team. The new members must be given access to the other community members and to the group memory. Tacit knowledge and explicit knowledge about the community itself as well as its work-related domain of knowledge need to be shared, and the group stories must be told and further developed. Original members provide instruction in and model behavior for the newer members so that new members learn what the community is about, how they fit in, and what roles they play.

Just as important, the new members bring with them accumulated knowledge and behavioral preferences. The overall community adds to its knowledge and behavioral repertoire by learning from new members. This increased complexity carries new challenges for the community in ensuring that all members have access to one another and to the knowledge they need. It also encourages the members to periodically re-examine the community's desired scope, both in terms of knowledge domain and membership.

The organization begins to be interested in accessing community members, learning what the community does, and how it benefits the organization. The organization may set up regular interaction with the community at this stage to keep track of its activities and progress. The organization may also intervene in community work, typically by either supporting growth efforts or trying to redefine scope, mission, or mode of operation; occasionally these behaviors interfere with the community's development.

Process. At the engaged stage, processes that were previously developed at the building stage are implemented and are running. Supporting processes for gathering feedback and measuring community effectiveness to help the community learn about itself and continuously improve are important.

Managing a community's intellectual capital tends to become more complex by this stage. Processes that facilitate acquiring, disseminating, and maintaining or furthering the evolution of knowledge are especially helpful. The community needs to identify gaps in its knowledge base and fill those gaps, and it constantly looks for new ways to advertise for, create, pilot, harvest, and motivate contributions.

Recruiting and socialization at the engaged stage need to be treated as a process, although a community will still take advantage of *ad hoc* opportunities,

Table 5 Engaged stage enablers that promote access and learning

Stage	Engaged
Fundamental Function	Access and learning
People Behavior	<p>Members:</p> <ul style="list-style-type: none"> ● Develop trust in and loyalty to the community ● Commit to the community ● Outreach to new members ● Model knowledge-sharing behavior ● Tell community stories ● Actively search for and contribute material to build the community knowledge base ● Promote and participate in knowledge sharing <p>The organization interacts with the community and learns of its capabilities.</p>
Process Support	<p>Socializing new members Managing workflow Executing life-cycle process for developing and managing knowledge Supporting tacit knowledge exchange Developing and disseminating communications Gathering and managing feedback Correcting problems and adjusting Re-examining and modifying community definition and scope Ensuring self-governance and self-regulation</p>
Enabling Technology	<p>Portals Expert and community “yellow pages” or locators Language translation capabilities Electronic surveys, polling, and other community-sensing or feedback tools</p>

such as fortuitous conversations between old and new members, to promote growth and development. Even if the community reaches a size that it decides is appropriate, it must still continue processes for recruiting and socializing members in order to ensure vitality.

Finally, communities at this stage are increasingly aware of the importance of exchanging tacit knowledge. They seek ways to enhance person-to-person communication so that the tacit knowledge of the whole community is shared and developed, and members learn in the context of doing. A community that has never had the opportunity to meet face to face must find ways to compensate for this need.

Since the organization is now conscious of the community, there is mutual benefit to and opportunities for integrating the community’s knowledge management processes with other organizational processes and workflows, such as new project initiation, business planning, end-of-project reviews, research development and overall processes for developing intellectual capital.

Technology. The community needs tools to help it learn about itself—electronic surveys, polling, measurements gathering and analysis tools, and so on. Simple measurement reporting tools are often integrated at this stage. Community members who work directly in managing intellectual capital benefit from workflow support.

As the explicit knowledge base grows, technologies that help with customized searches are valuable. A community portal can be particularly helpful for individuals who are joining the community and need assistance with access.

To aid with the membership growth, expert locators are useful for identifying and finding new members, and a “yellow pages” for the community helps keep track of the membership.

Since many of these knowledge network communities are cross-national and multilingual, natural language translation capabilities, although still limited, are helpful at this stage to handle the expanding knowledge and peer-to-peer communication needs.

Table 6 Active stage enablers that promote collaboration

Stage	Active
Fundamental Function	Collaboration
People Behavior	<p>Individuals engage other community members to solve problems and do “real work”</p> <p>The community creates focused work groups</p> <p>The community connects to and interacts with other communities</p> <p>The organization actively supports and measures community work</p> <p>The organization begins to rely on the community’s knowledge to contribute to business value</p>
Process Support	<p>Problem-solving and decision-making</p> <p>Sensing and assessing the organizational environment</p> <p>Enhancing community learning and feedback processes</p> <p>Integrating with organizational processes</p> <p>Linking with other communities</p>
Enabling Technology	<p>Electronic meetings</p> <p>Collaboration tools, such as for issue-based discussion</p> <p>Team work rooms</p> <p>Analytical and decision-making tools</p> <p>Integration of community technology with the applications and technology of the organization</p>

Active stage. In this subsection we describe the enablers that promote collaboration in the active stage as in Table 6.

People. Collaboration becomes a fundamental function at the active stage. Community members call on one another to do work outside the community, focus together to solve business problems, and jointly pursue business opportunities. This function means that community members have gained detailed knowledge about one another’s capabilities, understand the value of intracommunity knowledge exchange, and rely on the expertise and knowledge of the community. A key behavior is that members turn to the community early on when faced with a new or difficult work problem. Members respond to requests from other members as though it is their job. They circumvent organizational barriers in order to work with other community members.

Underlying skills and competencies that helped people work well at the active stage include: ability to team and work with others, skill in recognizing a person’s capabilities and building teams, facilitation, coaching, business acumen, and ability to leverage the formal and informal networks of the organization.

The community also reaches outward, connecting with other communities across the organization to share knowledge when needed and to help deal with business problems or opportunities.

The organization at this stage wants, and often relies on, the community to do work that will advance the business. The organization gives support, but it also expects business value from the community’s actions.

Process. Three types of group dynamics processes help a community effectively channel its capabilities to tackle the multiple business issues it faces: team building, group problem-solving, and decision-making. The community also needs highly flexible management processes to coordinate multiple work groups and teams.

For the community to actively work with other communities and organizational units, process integration is important. This integration enables the community to have access to other experts as needed, be informed of business needs and direction, and learn of opportunities to develop intellectual capital in conjunction with customer and internal projects.

Table 7 Adaptive stage enablers that promote innovation and generation

Stage	Adaptive
Fundamental Function	Innovation and generation
People Behavior	The community changes its environment through creation of new products, new markets, new businesses. Members working together advance the knowledge, and even the definition, of their field. The community sponsors new communities. The organization uses the community to develop new capabilities and to respond to and influence markets.
Process Support	Adapting responsively to the environment, exhibiting dynamic stability Developing advanced boundary processes Mentoring the formation of new communities Focusing on innovation
Enabling Technology	Pilot uses of technology Integration with the technologies of external organizations Technology transfer

Overall learning processes improve significantly at this stage, not just for community members as individuals, but also for the community as a whole. The community specifically develops feedback processes to learn about the effects and effectiveness of the business work that the community does. It then coordinates its feedback process with the reporting needs and processes of the organization.

Technology. Tools for both directive and nondirective collaboration are important at this stage. The community makes strong use of tools such as customized collaborative spaces (e.g., TeamRooms or Knowledge Cafe¹⁹). In addition, e-meeting technologies enable the community subgroups to move forward with their collaborative work. An issue-based discussion facility²⁰ or other structured discourse tool can aid the groups in coming to decisions as well as recording and retaining, for future reference, the arguments and discussion that led to the decision. Other analysis and decision support tools may be brought in as they relate to the problem area being worked on.

At the active stage, technological effort is also directed toward integrating the community's work with major organizational applications for both business delivery and for training and education.

By this stage, the community is not only using technologies incorporated at previous stages, but it tends

to become a more sophisticated user of the tools and to place more requirements on the technology developers to enhance the current tools and to implement new technologies.

Adaptive stage. Below we describe the enablers that promote innovation and generation in the adaptive stage seen in Table 7.

People. At the adaptive stage, where innovation and generation are the fundamental functions, community members are engaged in work that is changing what the business does or sells. They assume responsibility for working with others to significantly advance the knowledge of their field.

The community members seek to influence more than the supporting organization. They reach out to and interact with other communities and to other associations and organizations to generate new business, new products, even new markets.

The community has evolved so much that it can sponsor new communities and may even create charters for them.

Underlying skills or competencies that may help people work well at the adaptive stage include: research and experimental orientation, marketing and sales skills, competitive intelligence, ability and willingness to be a thought leader, confidence, adaptability, prag-

matism, and a desire to explore the unknown and to create and communicate a future vision.

The organization is vested in the community and becomes dependent on the community to help develop new capabilities for the organization and to respond to market demands. The tendency, however, may be for organizations to take over a community that reaches this level. The work being done by the community becomes too important to the business for the organization to allow the community to continue without formal direction and management by the organization. In essence, the organization converts the community into a business unit. However, the community may not actually disappear, but simply “drop back” to a previous stage and either co-exist with the business unit or go “underground.”

Process. In the adaptive stage the community relies on flexible and adaptive processes that are oriented toward its external environment. The community works in “sense and respond” mode²¹ so that it can stay constantly attuned to changing conditions and readily respond to and help direct those changes.

The community focuses its existing collaboration and communication processes on innovation, and it incorporates or integrates with processes for research and development. One of the outcomes of its innovation efforts is the creation of new processes, methods, and techniques that advance the state of knowledge in the community’s domain.

The community, by this stage, has learned how to support the formation of new communities and now actively mentors their development. It is looked to as a leader, and other communities, groups, individuals, and organizational units will seek out the community to learn from it. It needs processes to transfer its knowledge beyond its boundaries.

When a community tries to function fully at the adaptive stage, however, it faces a danger, not only of being co-opted by the larger organization as noted above, but of potentially losing its identity as a distinct, separate entity because it becomes too fluid in its interactions with the myriad groups and agencies with which it deals. One potential counterbalance, and what may be a critical process at this stage, is for the community to develop a highly evolved boundary subsystem.²² This subsystem would give the community a degree of control over the speed and type of exchanges that occur.

Technology. At this advanced stage, the community employs whatever technologies will advance the field and allow the community to innovate. The community initiates and participates in pilot uses of technology, both by bringing in new technologies and becoming a pilot group for external agencies and also by sponsoring pilots within other groups.

The community expands its technological reach beyond its own organization, integrating the use of external technology with its own tools. The community might use external technology, such as an on-line electronic trading room or industry association bulletin board, to communicate and collaborate with the “outside world.”

The results of this technology experimentation and use foster the community’s taking a strong role and responsibility for technology transfer within the organization, increasing not only the development and use of multiple technologies but also the overall technical competence of the members.

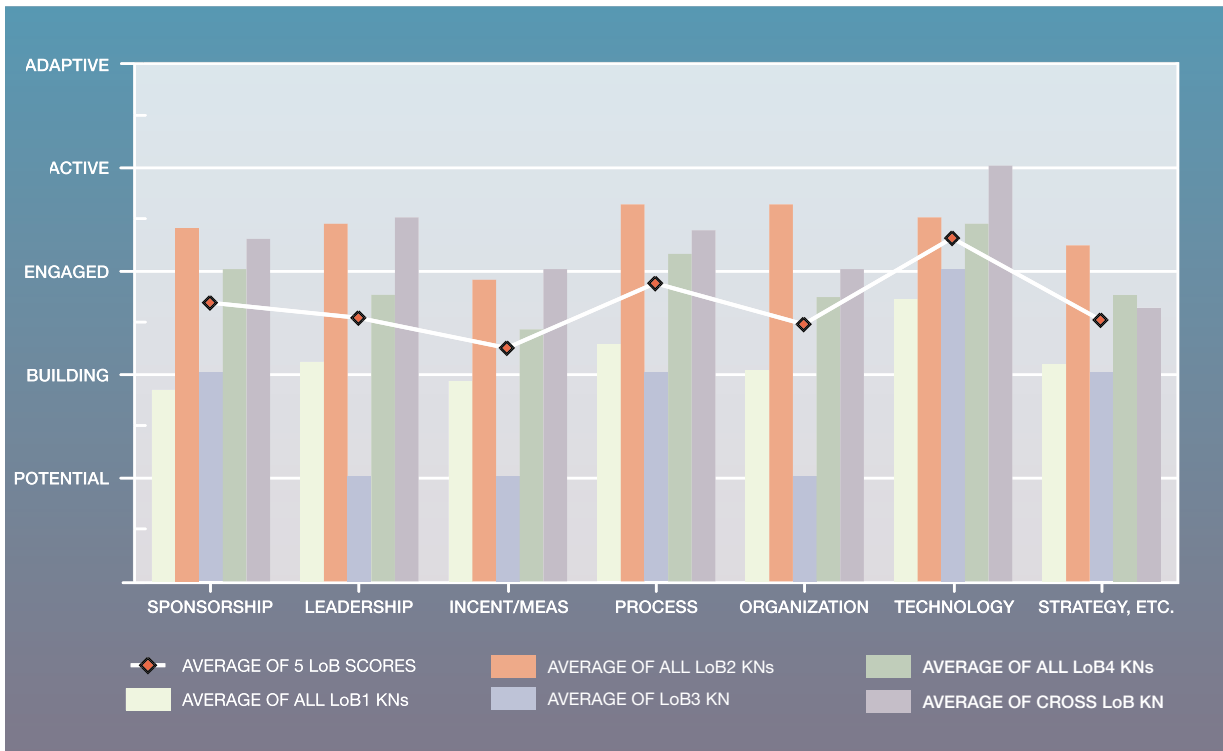
Applying the evolution model to the knowledge network communities. After outlining the evolution model, the knowledge management team examined the full set of knowledge network communities in order to classify them according to stages of the model. We used information from health checks, annual strategic and operational planning, our enabling technology evaluations, and process improvement activities to position the communities.

We aggregated the knowledge network community assessments by line of business to reveal variability across organization environments. Community assessments are based on the elements of the IBM Global Services framework referenced in Figure 1.

Figure 2 shows the line of business (LOB) distribution of knowledge network communities across the model stages. We saw that, as expected, the communities, on average, fell within the building, engaged, and active stages. We also saw that the average stage development varies significantly across lines of business. We can speculate that this variability across lines of business is due to the level of line of business support, but the further discussion of this topic is beyond the scope of this paper.

Although these health check data provide a good view of knowledge networks at given points, they do not adequately show how a community evolves over time. In order to understand progression, we looked

Figure 2 Knowledge network evolution stages by framework element and by line of business



at specific knowledge networks using a scenario and case study approach.

Combining the model, periodic assessment data, participant observation, and community stories from the set of knowledge networks, we can build scenarios and cases that describe the movement and characteristics of knowledge network communities through the stages of evolution. We discuss some of these scenarios for the building, engaged, active, and adaptive stages.

Scenarios of building communities. We have seen several different scenarios that can apply to a community at the building stage: the community is continually building; the community suddenly re-energizes; the community puts too much emphasis on technology at the expense of people and process; or the community disappears.

Continually building. A few knowledge network communities have never completely made a transition

into the engaged stage. They have an identifiable community, a few processes to manage their intellectual capital, and one or two core group members who handle contributions. They provide value for the sponsoring organization by acting as a magnet for capturing intellectual capital, and they seem content to continue functioning at the building stage.

Suddenly re-energized. Sometimes a knowledge network community that stayed at the building stage for a long time re-energizes. Triggered by a business environment change such as an emerging market opportunity, it begins to move purposefully toward the engaged stage. The core team develops a renewed interest in reaching out to and attracting new community members and in acquiring more intellectual capital. We have seen three different things happen:

1. Communities that have bonded and outlined a set of supporting processes at the building stage begin to execute those processes. These communities move to the engaged stage very quickly.

2. Communities that have bonded but have not established a set of processes move to the engaged stage but progress at a slower pace.
3. Communities that have not bonded sufficiently need to rediscover who they are and what they are about before they progress.

Too much technology, not enough process or people. In these building communities, the core group invests a significant amount of resources on technology at the expense of reaching out to the broader community and establishing community sustaining processes. They often use the term “community” to identify people assigned to a particular practice or business unit rather than people who share a common interest or expertise. Usually the core group members are innovators and early adopters of technology who are very effective at applying new technology to business problems. However, since they missed community-oriented operating principles and processes that make a community sustainable, they need to address these gaps and establish ways to encourage people to participate in order for the community to move beyond the building stage.

Disappearing communities. We have seen three different circumstances where building communities disappear. They struggle to define their collective identity but never actually accomplish their goal. They build a full process for managing intellectual capital for a broad group of persons but try to sustain this process with just the small core group. They fail to develop processes for incorporating and socializing new members.

In any of these three circumstances, the small core group tends to become frustrated because of the demands on them to manage the knowledge base, maintain a growing body of intellectual capital, and at the same time, act as experts sharing their tacit knowledge. As time goes on, the knowledge base becomes dated. Would-be community members, who attempt to join but are not incorporated, become frustrated and stop any further attempts to contribute.

At this point, the building community tends to disappear. If the knowledge domain is considered valuable enough, the core members may be absorbed into an organizational unit and continue managing intellectual capital but not from a community perspective. Alternatively, if the core group sees itself as similar to another existing community, it may try to merge with that community.

Scenario of an engaged community. This typical scenario involves a community that originates with potential members who are relative strangers. A selected group of experts are given a charter by a business unit to form a community for the purpose of capitalizing on the members’ expertise to provide high-value customer services.

At the potential stage. The potential members are invited by the sponsoring executive and the leader to participate on the knowledge network core team.

At the building stage, jointly establishing a taxonomy and knowledge base category structure to manage explicit knowledge content is the important test of a community.

They meet together for the first time on a facilitated teleconference during which each person has the opportunity to share what he or she does related to the domain of knowledge as well as his or her individual area of expertise and aspirations for the community. They learn together on these calls about the knowledge management strategy, intellectual capital management concepts, activities, and roles. Each person decides whether to continue on the core team.

At the building stage. Core group members need much time to learn about one another and discover how to operate as a community. If they are lucky, the obvious gaps in common understanding are identified and addressed early on. If not, and the gaps are discovered after they begin the business of building a structure and operating principles, the trust and loyalty that is required to coalesce will develop more slowly.

Learning and modifying the processes together builds a foundation for the community by establishing a sense of common purpose. Activities of developing a community plan are set up to maximize the opportunities for the group to work together so that trust can develop. The co-created processes and plan become an explicit part of the shared history.

Determining who to include and who to exclude from the community is an important unifying decision process for the core team at this stage. The decision-

making process involves discussion, debate, and evaluation of the community's objective and how new members would contribute to meeting that objective. A specialized technology for issue-based structured collaboration is introduced if it suits the nature of the community.

Jointly establishing a taxonomy and knowledge base category structure to manage the explicit knowledge content is the important test of a community at the building stage. When a community has difficulty with this task, we found several factors are at work. First, diverse roles of the community members make it difficult to find common ground. Second, the community's knowledge and work—its offerings, services, and products—are changing, and the core team is attempting to build a structure that accommodates the old knowledge while preparing for the new. Finally, the trust-building started in the potential stage is not solid enough.

At the engaged stage. The community moves into the engaged stage as it starts implementing its plans. The community begins a membership drive and training program, reaching out to the broader community to populate the knowledge base, and provides opportunities for community knowledge sharing through activities such as publishing a newsletter or hosting conference calls. The community develops and publishes something meaningful and useful to community members such as their methodology and work products. It demonstrates continuous improvement activities such as restructuring the intellectual capital categories or tracking and publishing statistics on most-used intellectual capital. At the engaged stage members acknowledge that they derive benefit from the community, and the community provides broader business value to the sponsoring organization.

Scenario of an active community. Here we give some examples of what was done by communities considered to be in the active stage.

Still in the engaged stage but with active stage characteristics. In their evolution, during the engaged stage, these communities went beyond the scope of the average community. They incorporated a broader set of professionals into the community than was originally planned. They held "sharenets"—global meetings of community professionals who come together to present intellectual capital and new ideas and to have discussions and learn with their colleagues from around the world. Such a meeting was

significant because it provided a forum to build a body of tacit knowledge and further developed and reinforced the community's shared history.

The processes were executed with exceptional discipline. The community membership drives were aligned with service delivery practices that depended on the community's domain of knowledge. The projects had specific goals, targets, and milestones. Progress was reported to the sponsoring executives.²³

**Communities of knowledge
do not have to reach
the later stages of evolution
to contribute value to
the business.**

The communities provided requirements for process, operations, and technology changes to the knowledge management program team to drive improvements.

New community roles were identified and established. For example, one core team incorporated a language assistant role to help other subject matter experts handle contributions in multiple languages; another core team established a network of intellectual capital advocates who served as emissaries to project teams to promote the use of the community's intellectual capital and harvest new contributions.

All of these communities enlisted executive and technical leadership to overcome organizational obstacles. For example, they changed priorities on workstation and application roll-outs; they leveraged investment funding for knowledge capture and development activities; they provided relief for members who had high service delivery commitments and wanted to contribute intellectual capital. These actions demonstrate that the knowledge networks were learning to operate and establish their identities in the context of the organization and to evolve to the active stage.

At the active stage. We only have a handful of knowledge network communities at the active stage. These communities invested their time and resources to

adapt and refine processes, test new technology, and ensure that the community concept was firmly planted in the “hearts and minds” of the members. The members began to freely share their experiences and advise other developing knowledge networks, going beyond the boundaries of their knowledge domains.

One active stage community was able to weather a major organization change with the community not only intact but seemingly even stronger. The ability to align the community to the changing business direction, while maintaining its unique identity, demonstrated the ability of members of a community to pool knowledge and work together to address business issues—characteristics of a community in the active stage.

The same community was able to assimilate new members from a firm acquired by IBM. Another community was able to support a rapid expansion of the practices that used their domain of knowledge. They were all able to establish alliances with other knowledge network communities in related competencies. They invited other communities to participate in their “sharenets.” They coached other evolving knowledge network community core teams.

Scenario of communities on the path to adaptive. The few communities that we recognize as moving into the adaptive stage have co-created, through global collaboration, something of tangible value that increased market share and service practice profitability.²⁴ They have identified and pursued new markets in a changing business environment.

One of these knowledge networks took on the responsibility to actively mentor the formation of other communities in related knowledge domains.

There is evidence that these communities are establishing the new structures and processes that they need for leveraging their knowledge, not only to compete effectively, but to influence, and potentially redefine, their environment. We are waiting to see and learn from them as to how they might evolve fully to the adaptive stage.

Concluding remarks

We conclude by looking back at what was learned and looking ahead at what must still be done.

What we learned. By taking a look back at what was accomplished by these knowledge network commu-

nities over more than five years, we discovered and learned several important lessons—lessons that are consistent with those learned by community development practitioners in other organizations.

First of all, community development is not a “one size fits all” proposition. Each community that we observed had its unique “personality,” strengths, and challenges. After developing and then using the evolution model, we were able to sort out some of the individual differences and assess characteristics more objectively. It let us see that, although there are distinct stages that communities transform to, they also move back and forth between stages. This movement often confounds and frustrates members, particularly the community leadership. Understanding a community evolution model might give a community, as well as any sponsoring organization, the confidence to proceed even when this back-and-forth movement occurs.

We also saw that communities do not have to reach the later stages to contribute value to the business. Even communities that are in a continual stage of building can provide a magnet for capturing and sharing intellectual capital and attracting skilled resources. And they are in a position to advance, if the business needs or community members require it.

Finally, at any level in the evolution model, basic people, process, and technology factors work together to nurture and sustain the community. The approach taken by IBM Global Services that pulls together the people, process, and technology factors into a knowledge management framework facilitates both community evaluation and successful development. We believe that this knowledge management framework might also be useful for other organizations that include communities of practice in their business models.

Where do we go from here? As we develop and test a comprehensive set of indicators of knowledge network community health and evolution and accumulate the information, it would be beneficial to compare our methods and results for assessing communities with those of other organizations. It would also be valuable to refine the factors influencing health and further align them to the different stages of evolution.

Multiple types of technology are available today that can be employed to enable community processes and

behavior. We would like to see how communities integrate capabilities such as persona pages, personal Web spaces, enhanced discussion facilities, knowledge portlets, content organization, and advanced searching and retrieval techniques, and we would also like to see whether these new technologies facilitate functioning and growth at each evolution stage.

There are many areas related to community of practice evolution that we would like to explore particularly in other organizations and environments; for example:

- How do adaptive stage communities develop, and can they exist and thrive over time, still remaining communities?
- How can organizations better learn to accommodate communities of practice and contribute to their development?
- How do communities of practice develop and sustain themselves if their membership spans multiple organizations and groups?
- What can a community of practice do, at each stage of development, to attract and retain talented professionals? How might they provide the kind of creative, social environment that attracts professionals and appeals to thought leaders?
- How do key functions, such as the socialization of new members, change as the community evolves?
- What “techniques,” such as storytelling and other narrative techniques, are particularly valuable in community formation and in providing a thread of continuity during evolution?

Communities of practice will continue to be an important aspect of the business model at IBM Global Services and other companies. As people become more acclimated to working in communities of practice, as organizations learn how to better support communities, as processes become more robust, and as enabling technology becomes both simpler and more sophisticated, we believe communities will assume an even more important role in organizations, and new forms of community will develop. By employing what we have learned with our knowledge network community experience and the community evolution model, and by continuing to observe and learn, we hope to facilitate the building of those communities within IBM and to provide a foundation for achieving the results that will be expected from the communities of the future.

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Cited references and notes

1. One of the well-known definitions of a community is provided by Sarason. He describes three major elements of a community: first, the community members perceive a similarity to others in the community; second, members recognize a mutual interdependence; and third, members feel that they are part of a larger structure that is both stable and dependable. Since these are elements applying to communities in general,

- they should apply to the specific type of community that we deal with here, namely the community of practice. S. B. Sarason, *The Psychological Sense of Community: Prospects for a Community Psychology*, Jossey-Bass Publishers, San Francisco, CA (1974).
2. E. Lesser and L. Prusak, *Communities of Practice, Social Capital and Organizational Knowledge*, White Paper, IBM Institute for Knowledge Management (August 1999).
 3. E. C. Wenger and W. M. Snyder, "Communities of Practice: The Organizational Frontier," *Harvard Business Review* **78**, No. 1, 139–145 (January 2000).
 4. W. M. Snyder, "Communities of Practice: Combining Organizational Learning and Strategy Insights to Create a Bridge to the 21st Century," *Academy of Management Conference*, Boston, MA (August 1997).
 5. For example, the IBM Institute for Knowledge Management (http://www.vistacompass.com/ikm_public/index.htm) and the American Productivity and Quality Center, or APQC (<http://www.apqc.org>) include "communities of practice" (by one or more names) as a research topic for member organizations. Knowledge-management-related conferences (e.g., KMWorld and Braintrust) routinely include communities of practice as a key agenda topic.
 6. By the beginning of 2001, IBM Global Services had over 140,000 experts working in 160 countries. IBM Global Services' lines of business included: Business Innovation Services, Integrated Technology Services, Strategic Outsourcing, and Learning Services.
 7. For a description of the beginnings of the IBM Global Services knowledge management program, including the start of communities of practice, see: R. Azzarello, D. Haack, F. Schoeps, and B. Smith, "The Design and Implementation of Intellectual Capital Management," *SIM Network* **XII**, No. V, 1–5 (December 1996).
 8. *Explicit knowledge* is knowledge that is "written down," documented, or recorded in some way. Sometimes explicit knowledge is further considered to be procedures, steps, specifications, etc.
 9. T. Stewart, *Intellectual Capital: The New Wealth of Organizations*, Currency Doubleday, New York (1997).
 10. The small set of common roles includes a *community leader*, a core team with a *router* (who first reviews new submissions of intellectual capital and decides who should evaluate them), and *category owners* (who are subject matter experts in the different subareas of knowledge and who assume responsibility for managing intellectual capital in their subarea).
 11. *Tacit knowledge* is knowledge that is primarily in the heads of people. Michael Polanyi describes tacit knowledge as being "in-dwelling," meaning that it is constructed from our experience in the world—the sense we make of what we see, touch, feel, and hear. N. M. Dixon, *Common Knowledge, How Companies Thrive by Sharing What They Know*, Harvard Business School Press, Boston, MA (2000).
 12. A description of ICM AssetWeb is provided in K.-T. Huang, "Capitalizing on Intellectual Assets," *IBM Systems Journal* **37**, No. 4, 570–583 (1998).
 13. E. C. Wenger, "Communities of Practice: Learning as a Social System," *Systems Thinker* **9**, No. 5, 2–3 (June/July 1998).
 14. R. McDermott, "Community Development as a Natural Step: Five Stages of Community Development," *KM Review* **3**, No. 5 (November/December 2000).
 15. *Ibid.*, p. 6
 16. The Systems Engineering Institute (SEI) of Carnegie Mellon University has been developing capability maturity models for software engineering for over a decade. Their work is widely known, and the range of material is most readily viewed by accessing their Web site: <http://www.sei.cmu.edu/>.
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 18. J. Horvath, L. Sasson, J. Sharon, and A. Parker, *Intermediaries: A Study of Knowledge Roles in Connected Organizations*, White Paper, IBM Institute for Knowledge Management (September 2000).
 19. Knowledge Cafe is a Lotus Notes and Domino application that is designed to help people and teams work together more effectively by providing powerful information sharing and collaboration facilities, both for on-line and disconnected use. It is an application used internally in IBM.
 20. For an example description of what an issue-based model involves, see A. Dutoit, B. Bruegge, and R. Coyne, "Using an Issue-based Model in a Team-based Software Engineering Course," *Conference on Software Engineering Education and Practice (SEEP96)*, Dunedin, New Zealand (January 1996), pp. 130–137. Basically, the model provides a structure for starting an issue, then creating proposals to address the issue, providing arguments both for and against the proposals before coming to resolution.
 21. S. Haeckel, *Adaptive Enterprise: Creating and Leading Sense-and-Respond Organizations*, Harvard Business School Press, Boston, MA (1999).
 22. The boundary is "the subsystem at the perimeter of a system that holds together the components that make up the system, protects them from environmental stresses, and excludes or permits entry to various sorts of matter-energy and information." J. G. Miller, *Living Systems*, McGraw-Hill Book Company, New York (1978), p. 3. This classic definition of a boundary is developed in the seminal work by Miller that demonstrates the similarities of processes and structures across multiple levels of living systems as well as the emergent properties that develop at each level. This work also provides a wealth of hypotheses and data about the functioning of a boundary subsystem.
 23. The project is described in an IBM internally published document: P. Schuett, *How to Make Knowledge Management Work in IBM—The Experience Gathered in ESM*.
 24. John Helmbock, the community leader, describes the global creation, development, and value of the creation of the model in an IBM promotional video tape entitled "Intellectual Capital Management," Version 1 (June 1997), now out of print.

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