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The Craft of Connection

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Organizational network analysis is helping companies share knowledge worldwide, one natural broker at a time.

by Tim Laseter and Rob Cross

Ask business executives about operations strategy and they will tend to discuss structural decisions: when to consider outsourcing, where to locate plants, and how to increase standardization through modular design. But if you query the same executives about their most pressing issues, their list will probably center on people: improving recruiting, investing in management development, increasing collaboration within organizations, and other challenges of managing the growing population of knowledge workers.

For help with their "hard" decisions about inanimate objects, executives have a range of techniques involving rigorous quantification: make/buy analysis, site selection studies, and engineering cost analysis. For decisions that involve the "soft stuff" about people, most managers are left to rely on more visceral techniques — judgment and habitual leadership style. Naturally, hard numbers don't, in themselves, make a decision inherently more effective. But even though people are far more complex than the most complicated factory design, companies can still be more rigorous in their methods for managing human communication.

Consider the variety of informal "communities of practice" found in most companies (and often across company boundaries), formed by people who collaborate to share best practices around a common vocation (or passion). Six Sigma "black belts" reach out to one another for help with complex statistical analyses. Field technicians share experiences and help one another troubleshoot initially intractable problems. Researchers tap other experts across the globe for specialized knowledge in developing new products. IT specialists collaborate to make disparate systems robust and complementary.

These communities rarely show up on organization charts; in the past, few were formally recognized by executive leadership. But that is changing now, as a growing number of large companies recognize and invest in these nebulous entities. In recent years, communities of practice have flourished in companies as diverse as Whirlpool (appliance manufacturer), Sanofi-Aventis

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(health-care conglomerate), Chevron (oil company), Caterpillar (heavy equipment manufacturer), and Halliburton (engineering and oil-field services provider). Each of these companies deliberately de-

around the company to identify consumer needs and use them to prioritize research and development goals. Since the initiative began, Whirlpool has gone from a handful of product introductions per year to

Real-world experience suggests that social networks should be actively managed.

signed and implemented a set of informal connections among people who were geographically or organizationally distant, but who had something in common to talk about.

The $21 billion Halliburton Company offers an interesting case study. Although currently a lightning rod for controversy because of its government contracting role in Iraq, historically the company has been better known for its Energy Services Group, one of the world's largest providers of products and services to the petroleum and energy industries. To link its oil-field operations throughout the globe, Halliburton launched a focused network-building program in 2002 that eventually led to the formal recognition of 19 communities of practice. These in turn have been credited with delivering tens of millions of dollars in bottom-line results.

The Whirlpool Corporation launched a similar effort in 2000 to stimulate greater innovation. First, 400 employees from a wide variety of functions were trained in a new process of "ideation" (brainstorming, refining, and articulating ideas for new products and processes). Then a subset of this group, dubbed the "innovation mentors," was set up as a community of practice, working with "attribute teams"

dozens, including the highly successful Gladiator line of appliances, workbenches, and storage systems for the garage. Again, the community of practice is credited as an essential catalyst.

The pharmaceutical company Sanofi-Aventis formed an immunology community of practice in 1999, after noting that immunology expertise played a central role in developing more than half of its product portfolio. By 2001, the community had evolved from an informal group into a formally recognized network-building initiative involving more than 100 scientists in 12 research sites around the world, organized into "working groups" focused on specific topics. These working groups hold quarterly teleconferences and Web conferences, and they are credited with increasing project success rates and reducing cycle time — both mainstay drivers of pharmaceutical company profitability.

The Chevron Corporation has more than 100 "operational excellence" communities in place. One of those networks saved an estimated $30 million in damages by rapidly sharing information about the potential hazards of a gas-drilling technique that had caused problems in one location. Caterpillar Inc. has

established more than 2,700 communities with more than 37,000 registered participants: employees, dealers, customers, and suppliers. The resulting quality and productivity improvements among dealers and suppliers were enough to justify the investment seven times over.

Despite the huge potential returns, few managers adequately invest in developing these kinds of networks and deliberately designing them to foster measurable business results. One reason for this is the misperception that networks, which are essentially self-governing communities, draw their energy from common enthusiasms and a shared sense of purpose and thus cannot be managed. Furthermore, some academics argue that communities of practice are emergent systems that must be allowed to form and evolve without direction.

But experience in real-world companies suggests that these entities can and should be actively managed, albeit not with conventional forms of management. Mandating goals and installing individual performance metrics can cause communities of practice to disintegrate, and indiscriminately throwing money (or collaboration software) at them without a clear set of priorities and a way of evaluating success can be equally wasteful. Success comes from applying the same rigor, time, and attention to the "soft issues" of designing and managing human connections that managers ordinarily apply to structural decisions about capital investment, logistics, and technology.

Cartography of Connections
The first step is to understand the existing patterns and relationships among community members. The

technique of organizational network analysis provides a means of making these invisible collaborations visible. This well-developed analytic methodology traces its roots to the 1930s, when Jacob Moreno set out to map the relationships of people in social groups in an attempt to reliably represent the ways in which group dynamics (like friendships, ostracism, popularity, and unpopularity) emerge. Today the approach rests upon a foundation of complex mathematics and analytic possibilities. (See "On Trust and Culture," by Karen Otazo, *s+b*, Autumn 2006.)

The sociogram, a tool of network analysis that Dr. Moreno pioneered, maps interactions among community members and can offer quantitative insight into the workings of the community. A typical map reveals at a glance the "network density" of the whole system (the number of actual connections among all members, relative to the theoretical maximum of connections from everyone to everyone) and the "individual centrality" of any person (the number of connections that he or she maintains to other community members). These factors can be assessed quantitatively along with other measures, such as "community cohesion" (which averages the shortest paths in a network — the smallest number of connections between any pair of people — and thus shows how close or distant

the connections are in general). These measures help to identify the critical players in the network, such as the "natural brokers" — people who, because of their role or personality, tend to be located on more of the short paths between community members.

At Halliburton, such a map was created in 2002 of the links among the community members of the Completion Products and Services business unit. The business unit's field experts — who work with oil producers to "complete" an oil well by converting it from exploration to production status — are located in oil-producing regions all over the world, including Saudi Arabia, Nigeria, Angola, Brazil, the Gulf of

One of the differentiators of high performers is their tendency to maintain ties outside their organization.

Mexico, Canada, and the North Sea. The initial sociogram showed self-contained, isolated spheres in each geographic locale. People in Nigeria talked mostly to others in Nigeria; the same was true in Saudi Arabia, Angola, Brazil, and so on. From every locale, however, there was continuous communication to the same three people, known as "global advisors," who maintained offices in the Houston corporate headquarters and dispensed advice upon request.

The map also identified a few exceptions to the norm of geographic isolation. For example, there were particularly strong informal ties between Canada and the United Kingdom. Upon investiga-

tion, it was discovered that several people had moved between those two locales; even after they moved, they kept their natural links with the people they'd left behind.

Drawing upon this insight, Halliburton made several strategic transfers of individual managers. The Gulf of Mexico had proved to be the source of many of the community's best practices — it had sustained improvements in performance, while the other six countries involved in the community had a 13 percent increase in a key corpo-

return to more senior managerial positions in their home country.

One year later, Halliburton assessed the impact of these transfers (and a few other interventions designed to achieve similar goals). The sociogram now portrayed a much richer web of information exchange, and not just between the Gulf of Mexico and the other business units. Saudi Arabia was sharing information with Brazil, the U.K. with Angola, and Nigeria with just about everyone. To measure the increased density more precisely,

graphic business units. Drawing upon experience at Halliburton and more than a dozen other companies, we have also identified several powerful interventions that operating managers can use to substantially enhance the bottom-line results of existing community efforts.

Luminescent Linkage

Transfers of staff provide an excellent means for breaking down geographic silos or "fragmentation points," but staff relocation can be costly for a company and difficult for an employee. With the increasing prevalence of dual-career families, many employees will not even consider relocating. Fortunately, many tactical levers remain for improving collaboration within an existing community of practice.

A baseline sociogram measures the degree of any current problems and highlights the key opportunities for improving network connections. One extremely dense sociogram, for example, emerged from the analysis of a well-known intelligence agency in the late 1990s. The diagram showed an intricate web of lines connecting many nodes. Unfortunately, each line depicted a *lack of awareness* of the expertise possessed by colleagues. As the investigations after September 11, 2001, have shown, the greatest challenge in the world of intelligence gathering occurs not in data collection, but in making the connections that generate insight. A poorly connected intelligence community has a lower chance of turning data into useful knowledge about real threats to the populace.

A relatively simple way to improve interconnectedness among community members is to develop a database that identifies each com-

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rate metric of bad performance, "costs related to poor quality" (for example, the cost of project delays). Using insights from the network map, some individuals from the Gulf who had strong local connections were selected to move to other regions; others with strong ties in their own regions were temporarily assigned to work in the Gulf. Significantly, the transfers were not random attempts to increase connectivity but targeted interventions, based on rigorous quantitative analysis and designed to achieve a specific objective: to increase the robustness and density of informal contact within the company as a whole. In addition, the transfers involved, as much as possible, people who had been identified as having high growth potential. This facilitated a second objective of investing in their professional development so they could eventually

Halliburton's research team analyzed the community's "degrees of separation": the number of personal referrals needed to connect someone who needed a particular piece of knowledge with a person who could impart it. This metric of inconvenience and inefficiency had dropped by 25 percent. Other metrics were even more telling. By sharing best practices among regions, especially some emerging insight from the Gulf of Mexico, the business unit increased revenues 22 percent while simultaneously lowering the "cost of poor quality" metric by 66 percent. Additionally, productivity improved by 10 percent and customer dissatisfaction dropped by 24 percent.

This experience with Halliburton demonstrates the value of actively managing network relationships by transferring community members across traditional organizational boundaries, in this case geo-

munity member's areas of expertise. For example, a searchable database designed around key words — indicating, for example, such subject areas as "China," "economic forecasting," or "nuclear weapons" — can allow community members to swiftly identify appropriate experts. To ease the tension of contacting an unknown colleague, we also suggest that database profiles include some personal information. Knowing that the person you're contacting shares your hobby or alma mater can help start a conversation that might otherwise never happen.

Such databases are worth the small investment of time they require, but no purely technological solution will be enough to spark effective collaboration among community members. Many people are reluctant to ask colleagues whom they don't know personally for help, even within the same organization, and for a wide range of reasons: Will they think I'm stupid for asking the questions? Are they really experts? How can I trust them? To reduce these inhibitions, companies can initiate face-to-face contact and well-structured virtual forums. These naturally lead to better introductions and interactions among erstwhile strangers and reduce the barriers to subsequent contact.

Both face-to-face and virtual events vary in effectiveness, depending on how carefully they are planned. Left to their own devices, most people naturally congregate with known peers. But if event organizers use data from a sociogram to design seating or to break out work groups, they can bring together people who have never met but have much to learn from each other.

And the web of connections need not be fostered by command; it can also emerge from the right sort of design. Recently, a large consumer products company held a global meeting of its researcher community. Each participant's name badge contained a radio frequency identification (RFID) chip, coded with data about that person and his or her work: some personal background, some areas of expertise, and current research interests. As the attendees mingled during the cocktail hour, their name tags glowed whenever two people with common or complementary interests passed. As people responded to the lights and made introductions, a computer tracked the connections and continuously updated a sociogram of the participants on a large projection screen. Although a natural extrovert may find such a technique gimmicky, it resonated well with the generally introverted and technology-enamored scientists and researchers. By the end of the evening, a poorly connected network had evolved into a richly linked community of practice.

Leveraging Natural Brokers

Fostering networks by increasing connectivity among all members is a common approach, but the greatest improvements can often come from concentrating on the "natural brokers" in the community through targeted interaction. Consider our experience with the technology community of one of the largest utilities in the United States. The CIO feared that this widely distributed organization was solving the same problem repeatedly, without consistent standards, strategies, or solutions. Given the wide range of specialists in her department — database managers, field support technicians, Web site developers, power plant operating systems overseers, and more — it wasn't surprising that her staff of highly skilled (and highly compensated) technologists often operated in isolation with limited collaboration and meager knowledge of each other.

To help, we conducted a network analysis and identified five "brokers" within the community. These people tended to provide the connections across organizational silos. We asked the five of them to get to know two specific people in parts of the network where they had few contacts. Inevitably, the natural brokers developed a better understanding of these colleagues' expertise; they then drew upon that knowledge as they fulfilled their natural role of linking others to requisite expertise.

The company also scheduled a regular one-hour call among the brokers, so they could learn from one another as they shared the challenges of creating productive links among people. Why, for example, did some peripheral players resist connection? Were they new to the company? Did they need better mentoring to help them integrate with the community? Or did they simply feel comfortable with their own expertise? Was that why they had never become aware of the value of reaching out to others?

Ultimately, the company publicized the brokers' collective observations about the expertise available within the community, and then coached the brokers to point people to other experts in the network rather than attempting to answer all questions directly. Once again, the results could be quantified through network analysis: Simply creating ties among these five brokers and

connecting each of them to two peripheral people improved the cohesion of the entire network by 22 percent.

Better communities of practice can be built not only by leveraging the natural brokers who already exist, but also by increasing or amplifying the personal network connections of critically placed people. Research has shown that one of the consistent differentiators of high performers is their tendency to maintain ties outside their unit and outside the organization. Using coaching, mentoring, or career development efforts to help a greater number of strategically important people diversify their networks can have a powerful impact on the individual and on the community as a whole.

Sociograms can also be used to reveal personal network maps, which cover a variety of dimensions and can offer rich insights into ways to improve network effectiveness. Typical is the case of a high-potential staff manager in a common career trap: an insular personal network dominated by other functional professionals within her own company. Although technically savvy, she did not use emerging communication technologies such as e-mail, instant messaging, and videoconferencing, all of which offered excellent means of reaching outside her day-to-day network of colleagues. By helping this central person expand the diversity of her network, the company improved her effectiveness and ensured that the community of practice to which she belonged would not be overly influenced by a small group of inward-facing people.

In another case, this time at a well-known financial-services company, network analysis highlighted the fact that a small group of emerging superstars generated the bulk of value-creating conversations. One woman in particular, the nominal leader of the community of practice, proved surprisingly central. On her own, she accounted for one-fifth of the value creation in the entire network. When we asked one of the company's leaders what would happen if she left the organization, he blanched. It turned out that she had recently submitted her resignation. Had the community been rigorously monitored earlier, more deliberate efforts to engage her might have prevented her sudden departure. Alternatively, a richer set of network connections could have been fostered to make the community less susceptible to the harm from the loss of a single individual.

The Networker's Reward

With the ongoing outsourcing of operational tasks to low-cost providers in India, China, and other developing countries, executives find themselves managing organizations full of far-flung knowledge workers. Accordingly, they must focus more attention on their people. Naturally occurring communities of practice offer a powerful vehicle for this. Managers can directly shape the relationships and information flows by providing better information access, by assigning roles such as formally designated "global advisors," and by working with individual informal "brokers."

A brain surgeon removing a tumor relies on steady hands and highly sophisticated imaging technology that provides continual feedback from the patient. Similarly, an operating executive who wants to make targeted interventions into emergent communities of practice requires a deft touch supported by good information. The goal is to extract as much value from these intangible assets as we do, at best, from tangible assets like infrastructure and machinery.

"The system we have developed is intrinsically rewarding to the users," says Guillermo Velasquez, a senior consultant in the Performance Optimization Group at Halliburton, and former knowledge management program manager for the Energy Services Group. "People participate because they see value. Experts get recognition. As time goes by and people in the community start to know each other, they develop reciprocity. An individual in need today may be tomorrow's expert providing the knowledge to help solve a problem. Gradually, we see much higher trust, and the community changes from the mode of 'getting the right information to the right person at the right time' to truly start building on each other's ideas to find a solution to a problem. In other words, that's when we start creating knowledge."

Achieving such an intangible goal may sound too soft for a hard-nosed operating executive. But in today's outsourced and lean enterprises, there is no viable choice but to tap the full potential of your people. Despite the inherently complex nature of human interaction, social network analysis provides a way to make targeted interventions to communities of practice. Our experience demonstrates that this approach can engender a true knowledge-creating organization. ✚

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