

PRACTICE VS. PROCESS

THE TENSION THAT WON'T GO AWAY

by John Seely Brown and Paul Duguid

John Seely Brown is Chief Scientist of Xerox and Director of its Palo Alto Research Center.

Paul Duguid is research specialist in Social and Cultural Studies in Education at the University of California, Berkeley.

The 1990s presented managers with a curious series of theories that dealt with quality, process and knowledge in quick but apparently haphazard succession. It may seem foolish to suggest that the succession in fact had an underlying logic. But logic we believe there was—a logic, moreover, that helps reveal important aspects of the structure of the firm. It reflects an enduring tension that arises between how knowledge in organizations is generated in practice but implemented through process. We believe that new knowledge is best created in single communities of practice but that formal organizational processes are generally needed to turn inventions into marketable innovations. The succession of management movements in the nineties may be an effort to maintain a productive balance between practice and process.

The decade opened with managers still flocking to the quality movement. Soon, however, they were pulled into business process reengineering. Then, as the decade closed, they turned towards knowledge management.¹ These three shifts required 180-degree turns in quick succession. The quality movement relied to a significant degree on bottom-up, locally generated insights. A principal managerial challenge here was to identify hot-spots of exemplary practice wherever they might arise—almost like a fire watcher looking for lightning strikes in the woods. These flames had to be encouraged to spread, however, and that was often much harder than expected. Good practice, often easy to spot, turned out to be hard to move.

Managers have since discovered that managing knowledge can be even more difficult—knowledge is hard to find, hard to move when you want it to, and equally hard to stop when you don't want it to move. Despite these differences, the two movements had a lot in common. In particular, given that people were often the source both of best practices and of knowledge, both of these movements paid much more than lip service to the idea of the people being the company.

Chronologically, the process movement came in between these two. It was markedly different. Though teams that analyzed processes might include people from across the organization, the newly engineered processes tended to be spread from the top down, rather than the bottom up, and from the center outward, rather than from the peripheries in. (The hierarchical military was a particularly successful reengineer.) Far from the people being the company, it was easy to believe from reengineering's perspective that process was more important than people, and structure more important than creativity.²

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After more than a decade of this back and forth between practice and process, bottom up and top down, and revolution from below or above, it's not surprising that many managers feel that they have been spinning in circles. Nor is it strange that many also feel suspicious of consultants. Some consultants had barely finished promoting quality as the definitive answer before they announced that it was passé and the new thing was process, a wave they rode until it was spent, when they looked to knowledge for new momentum.

WHY THESE CHANGES?

With the benefit of hindsight, we can offer several reasonable explanations for these radical shifts. First, management theory is as susceptible to fashion as anything else. And when fashions change, they often change radically. One day everyone is wearing broad lapels or short skirts, and the next the only thing to wear are narrow lapels and ankle-length skirts. Today's futuristic architecture is tomorrow's "retro" style. That's just the way fashion is. It's easy to read that sort of faddish shift in the radical swing from practice to process.

In a related vein, these shifts may also reflect the exhaustion of ideas—the desperate need for something new when an idea, however good, feels played out. By the time process reengineering came along, the quality movement, which did a lot of good, had often been reduced to little more than corporate cheerleading. And when knowledge appeared on the horizon, reengineering, which again did a great deal of good, had in many places become only a bogus rational for crude downsizing.

But fashion and exhaustion alone would suggest that management was primarily spinning in circles. Though the vagaries of management fashion may have played a part, we suggest that these changes in direction actually had within them aspects of progress that the recent surge in productivity may reflect. The followers of these movements may have been ascending a spiral staircase, not merely turning in place. When people came back to the same topics under the heading "knowledge" that they had encountered before under "quality," they were not at exactly the same point, but had climbed higher and seen further into the demands of organization and innovation.

This succession of business movements doesn't simply represent a succession of mutually exclusive alternatives, like long and short skirts, broad and narrow lapels. Rather, the alternatives are at their core complementary. Together they address challenges that coexist within a company. The process movement offered an organizational focus that the quality movement, for all its qualities, lacked. And knowledge management, for its part, can be seen as something of a response to process reengineering that supplemented it by overcoming its organizational tunnel vision.

In all, the succession reflects a logic that lies deeper than fads and fashions—so deep, in fact, that it is often hard to see. The surface shifts respond to substantial, complementary tensions embedded in the structure of organizations which arise around the creation, flow and implementation of knowledge. They are what we think of as the tensions that won't go away—tensions that

management has to find ways not only to live with, but also to make productive. And here lies a significant cause of that spinning feeling managers may have felt. Much of management training stresses overcoming or resolving tensions, not living with them. Instead of acknowledging the conflicting forces that pull at organizations, managers often lurched from one nostrum to another in an attempt to overcome what may in fact be an insurmountable tension.

STARTING UP

These opposing yet coexisting tensions show themselves in several ways. They are evident, for example, in the gap between predictions and evidence about the size and structure of the business firm. On the one hand, people announce that the firm is relentlessly becoming smaller and smaller as transaction costs fall. There's even a "law" of diminishing firms. On the other hand, firms are growing larger and larger through mergers and acquisitions, producing huge transnational conglomerates. One week we are astounded by the sheer scale of an AOL and Time-Warner merger only to find this topped in the following week by Vodaphone's acquisition of Mannesmann. Meanwhile, Cisco Systems, the firm vying with Microsoft to be the world's most highly valued company, grows by ingesting smaller companies at an alarming rate. Yet all the time we are being told that the big firm is dead. Similarly, some theorists proclaim that the true incubators of innovation are tiny startups. Yet the most innovative sector of all, the technology sector, is to a significant degree dominated by firms such as Cisco, Microsoft, 3Com or Sun—firms that astound everyone with their voracious growth. This opposition between claims and evidence, between shrinking and growing, and between large and small, like the opposition between management fads, reflects the different tensions firms have to deal with in creating and implementing knowledge.

Take those innovative start-ups that so dominate the news. Almost everyone is familiar with the way these sprout from a mere handful of people—Hewlett and Packard; Grove, Moore and Noyce; Wozniak and Jobs; Gates and Allen; Filo and Yang; or the small group of programmers that worked with Mark Andreessen to create Mosaic. Though all the companies built around these people (Hewlett-Packard, Intel, Apple, Microsoft, Yahoo and Netscape respectively) would grow to become huge corporations, in their early stages they were in essence little more than single communities of practice. And communities of practice are great incubators of knowledge.

Communities of practice are groups of people whose interdependent practice binds them into a collective of shared knowledge and common identity. Within such tight-knit groups, ideas move with little explicit attention to "transfer," and practice is coordinated without much formal direction. When people work this way, barriers and boundaries between people and what they do are often insubstantial or irrelevant since a collective endeavor holds them together. So, for example, histories of the early days of Fairchild (the firm from which Intel and just about every major Silicon Valley chip developer came) show the founding group working in overlapping pairs on a variety of tasks all of which

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had to come together to produce successful semiconductors. Last and Kleiner worked on a step-and-repeat camera, Last and Noyce worked on photographic emulsions, Moore developed the aluminum process, Hoerni developed planar processing, Hoerni, Noyce and Moore experimented with the critical silicon oxides, while Hoerni and Noyce developed the integrated circuit. It's impossible not to marvel at the shared knowledge, inherent coordination and collective understanding necessary to make this collaborative inventiveness possible. Were these tasks performed by five different labs within a corporation, the challenge would be quite different and probably insurmountable.³

The way in which knowledge is shared across tasks in such groups is evident in Frank Heart's description of the engineers who designed what would become the Internet:

*[It] was less than half a dozen people; and the group that did the software and hardware never did get to be more than about a dozen people. It was a tiny enough group that every one knew everything that was going on, and there was very little structure ... there were people who specifically saw their role as software, and they knew a lot about hardware anyway; and the hardware people all could program.*⁴

Alan Kay, reflecting on the team that developed the Graphical User Interface (GUI) at Xerox PARC, described the dynamics of a research group in terms that, though metaphorical, suggest similar near-interchangeability of the members: "Everybody has to be able to play the whole game. Each person should have certain things they're better at than the others, but everyone should be pretty good at anything."⁵

Finally, Charles Ferguson, describing the group he brought together to found Vermeer (which created the program that became Microsoft's FrontPage), again stresses the way in which knowledge within the enterprise was collectively shared across nominal job categories when the firm was small and the group tight:

*Whenever a technical or market problem arose, I would discover that the engineers had already thought of it, already designed it in, already encoded it. ... We never had problems with the disconnect between marketing and engineering that plagues so many software companies—our engineers were almost always on the same page with Randy, me and Ed Cuoco (our marketing director). ... Everybody understood what we were trying to do.*⁶

Each of these groups illustrates ways communities of practice operate. Shared practice binds the members together, building shared experience, reciprocal trust, social capital and a collective world view. In such conditions, the generation and circulation of knowledge may almost be indivisible. A great deal of work in such groups is arranged through what we call "negotiation in practice." This is a highly informal process requiring very little explicit direction. Think, by analogy, of the way people work out the turn-taking in a conversation. Normally, no one has to say, "now it's my turn to speak." Rather, turns are arranged on the fly, around almost imperceptible glances, nods and eyebrow raising, with very little attention to how it happens. In communities of practice,

the arrangement of who does what and when resembles fluid conversational turn-taking. Negotiation, communication and coordination occur primarily in practice itself, rather than as separate and distinct activities.

The examples also suggest the fluid structure of such groups. Given the shared trust and understanding involved and the preference for informal rather than formal coordination, such groups generally bypass many issues of hierarchy. The ties that bind are more lateral and egalitarian than vertical and hierarchical. None of this, of course, bestows blissful harmony on such groups. All accounts record important fights (though Heart and Ferguson note how few the fights were given how much was at stake). The shared world view, however, does make clear to insiders (in a way it is not to outsiders) what is worth fighting about—and what is not.

Such groups result when practice, *any* practice, is shared in a sustained fashion by a group. From this claim we draw a couple of conclusions. First, as the examples we have given show, these tight-knit communities of practice can occur within companies—Heart's group formed within BBN, Kay's within Xerox—or they can *be* the company, as in the cases of Fairchild's or Vermeer's early days. And second, though we have chosen to focus here on groups recognized for their remarkable inventiveness, these groups are not very different from other groups that work together in terms of the way knowledge is produced and flows. Elsewhere we have written in similar terms of repair technicians working for Xerox. Etienne Wenger has written of claims processors working for insurance companies.⁷ Neither of these communities is recognized for producing knowledge, but produce it and share it they do. In sum, the members of small groups working together, whatever the work, will tend to produce and share ideas to sustain and further that work. Even rote behavior is very rarely just rote behavior.

KNOWLEDGE CREATION AND WEALTH CREATION

But let us return to the startups such as Fairchild or Vermeer. Today, startups are prime sites for the sort of knowledge and wealth creation that society needs. But knowledge creation and wealth creation do not necessarily move harmoniously hand in hand. They can produce profound tensions. Knowledge, as we have suggested, grows in these tight-knit groups. Wealth, particularly the wealth of the startup, comes from growth, often quite explosive growth. Such growth will often pull these small communities apart or subject them to profound pressures. The theory here is not in the least new. Adam Smith long ago pointed out that growth was fueled by the division of labor. To create knowledge, then, you might want to develop a closely knit, minimally divided community like Heart's or Ferguson's. But to create growth, you will want to pull this community apart, allowing people to develop particular facets of the community's insights. So instead of the group in which the software designers work as dexterously with hardware or the engineers intuitively understand the demands of marketing, firms develop quickly into distinct communities of designers, of engineers, of marketers and so on.

As soon as this happens, coordination, which is almost implicit within such groups, becomes an explicit headache. Boundaries, almost invisible within

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communities, become a major source of concern between them. It's not surprising, for example, that after the remarkable initial burst of fluid creativity at Fairchild, Kleiner wrote a detailed and "unforgiving" set of engineering specifications and insisted that these be followed to the letter. The coordination that was quite informal within the founding group of scientists now became quite explicit. Kleiner realized that coordination between invention and manufacturing could not be taken for granted.

It may not be immediately obvious why the coordination within a single multi-faceted community of practice can't be replicated when the firm grows to embrace multiple single-faceted communities. Frederick Taylor, the father of scientific management, for instance, believed that the best way to improve the functioning of an organization was to break it down, like a machine, into its constituent parts and hone each of these separately. (In some ways Taylor might also be thought of as the father of business process reengineering.) But people are not quite like machines. When pulled apart and honed, they do not necessarily fit back together as before. Here again, it's worth attending to Adam Smith. While he noted that the division of labor leads to growth, he also noted that, as we have been arguing, specialization leads to specialized knowledge. So each of the communities that develops out of the startup's initial group will begin to develop knowledge along the lines of its own interests. The software engineers may pursue their own optimal strategies, the hardware engineers their optimal strategies, and before long each group may find that its solutions have become incompatible with those from the other. Now that practice is no longer shared directly, as knowledge develops along different trajectories, and as world views start to separate with those trajectories, negotiation and communication no longer come along for free. They have to be worked for. As groups develop their own "vocabularies," organizational discourse is in danger of becoming Babel and translation becomes necessary.

Xerox PARC provides a clear example. What became almost intuitive among the PARC scientists working on the GUI was almost unintelligible to the engineers who would be responsible for turning these ideas into working business machines. Because these two groups had not developed ideas together, insurmountable barriers of misunderstanding and consequent distrust developed between them. And unlike Kleiner at Fairchild, the PARC engineers lacked the authority—and had not developed the reputation, trust or social capital—simply to specify (as Kleiner had done at Fairchild) what was to be done.

At this point, it should be clear why one of the greatest challenges that startups face (one that venture capitalists tend to wring their hands over) is the search for a management team capable of dealing not only with the inventive idea of the original group, but also with the growth necessary to turn that invention into a successful innovation in the marketplace. Managers now have to bring in all those other people—the financial planners, the sales and marketing teams, the grunt programmers, the fabricators and manufacturers and so on—who are needed to take this product to market. And they have to develop the authority, reputation, trust and social capital to prevent the different communities being driven apart by their differing world views.

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THE PATH TO MARKET

Here it's important to realize that inventions rarely go to market on the strength of a single piece of inventiveness alone. The route to market, the route on which inventions become innovations, almost always demands "complementary" operations. This is clear in the Fairchild example. The integrated circuit did not come as a single flash of insight. It required a series of complementary inventions in materials science, fabrication, photographic and lithographic processes and so forth. Often this complementary invention requires contributions from quite diverse communities. The Xerox machine, for example, needed clever marketing and financing. Microsoft DOS required inventive contracting. If invention is in some ways a remarkable act of improvisation, innovation is more an act of orchestration, often with a very complex score and fractious musicians. In such circumstances, the concerted effort requires not self-coordination of a string quartet, but quite explicit conducting.

Yet in some ways the essence of innovation can be summed up quite simply. The Nobel economist Kenneth Arrow likens the process to "putting an item on [the organization's] agenda." Joseph Schumpeter says it is little more than "getting something done."⁸ Both are trying to stress that innovation isn't just inscrutable magic. It involves a great deal of commitment and hard work. Organizational agendas are complex items. Writing one requires, among other things, choosing the right topics, resolving conflicts, recognizing core competencies and best practices and rejecting leads that, though highly promising, threaten organizational coherence or direction. Similarly, getting something done is a profound challenge when it requires harmonizing headstrong communities whose diverse practices lead them in different directions.

And it's a challenge—the challenge of coordinating diverse practices—that is usually best met by establishing business processes. These are, essentially, Arrow's agenda items. They are the mechanisms whereby different communities of practice work not at random or serendipitously, but in a coordinated fashion. Process puts useful constraints on practice, providing a basic architecture which local changes in practice need to respect. It helps align different communities so that their separate practices, while possessed of enough autonomy to keep them vibrant, don't grow out of touch with one another. So process has to find the least amount of constraint necessary to enact the necessary amount of structure, to produce rigor without rigidity. While a lot has been written about best practice, best process remains to be defined. We think of best processes as elegantly minimal.

CONFLICTING FORCES

Visually, we think of process as a vertical structure creating an organizational spine out of the myriad practices the organization comprises. Contrastingly, we see practice as horizontal. That is, process emphasizes the hierarchical, explicit command-and-control side of organization—the structure that gets things done. Practice emphasizes the lateral connections within an organization, the implicit coordination and exploration that, for its part, produces things to do.

The two together, then, though they pull in different directions, are responsible for a firm's coordinated knowledge production and growth. Practice without process tends to become unmanageable; process without practice becomes increasingly static. As orthogonal forces, these two inevitably do not resolve into a single force. Both have to be acknowledged. As history shows, though, it's easy for one to overwhelm the other. Too much focus on practice may produce lots of energy and lots of ideas, but little, in Schumpeter's terms, is likely to get done. Too much focus on process, on a static agenda, while it may get a lot done initially, will tend to drive a firm's core competencies towards what Dorothy Leonard calls core rigidity.⁹

Famous examples of both abound. Netscape, which rose like a rocket only to fall like a stone, was by most accounts brim full of bright ideas and creative groups, but it lacked the sort of discipline needed to survive in the fearsome competitive environment when Microsoft took the field. Netscape failed, in this regard, to produce the necessary rigor when it was needed. As its own CEO noted, the timing involved in setting process on practice is the hard part, particularly when working on "Internet time":

The trick is to know when do you bring on the bureaucrats. There's a stage in a company's life where it's fine to be loosely controlled. There's another stage where you have to get more and more serious. What you don't want is to get too serious too soon. That stifles things.¹⁰

The history of Netscape suggests that it didn't get serious soon enough. The early history of Xerox indicates how the opposite can happen—you can indeed stifle things by moving too early. According to most accounts, this remarkably effervescent, innovative company fell victim to its own brand of "Fordism" when new management arrived wholesale from Ford. The new management screwed down the clamps of process tight. According to one account, "The Ford Men introduced rigid controls and a sense of authoritarianism that didn't exist before. A very hierarchical structure was put into place that had been unknown."¹¹ At this point, Xerox went into a tailspin.

Such accounts reveal the tensions between process and practice—tensions that, left unbalanced, can slowly kill a company, whether at the hands of process or of practice. These tensions can also cause companies to explode from the internal pressure. It didn't take long for the processes of AOL to send Netscape's chief scientist, Mark Andreessen, running out the door to start a new, innovative company. Similar explosions at Shockley, Fairchild and Xerox PARC helped seed the major companies of Silicon Valley. Imbalances of this sort don't only end with such explosions. Corporations often experiment with more gentle ways of loosening the ties that bind them together to try to foster creativity outside a process-driven structure. AT&T's Bell Labs, Lockheed's Skunkworks, GM's Saturn plant and Xerox PARC are all examples of this sort of loosening. These experimental "sandboxes" implicitly recognize the way process can stifle creativity, and they attempt to provide a safe environment for knowledge creation.

As the history of each of these examples suggests, the tensions between process and practice are not automatically resolved in this way. Reintegrating

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ideas generated outside back into those processes can be remarkably difficult. Xerox PARC unfortunately presents the most famous example of such difficulties. In the late 1970s, PARC developed most of the technologies that are now as essential to office work as the photocopier was in the 1970s. But, as we noted earlier, the knowledge that flowed so easily within the creative community at PARC would not flow across the borders of that community into the other Xerox communities necessary to turn invention into full-fledged innovation. Similarly, the transistor didn't make it across community boundaries in Bell labs.

Both these examples help emphasize our sense of the challenge that such things as communities of practice or social capital create for a firm. Communities are critical sites of invention. The practice-driven, collective trust and coordination they bring with them in turn creates social capital among the participants. But these strong internal bonds, while engines of invention, can simultaneously be impediments to innovation. Trust within a group can simultaneously generate distrust of those outside. Increasing local social capital can generate disdain for other, more distal groups. Indeed, social capital may actually help ideas flow more readily out of a firm than across it, along the networks of social capital created among people engaged in similar tasks in different firms.

The ideas created at PARC ultimately made the trek from invention to innovation in other firms, not just Apple, but also Adobe and Microsoft. The ideas created at Bell Labs made the trek to Shockley (where the transistor was developed). The semiconductor, which failed to cross boundaries within Shockley, was developed first at Fairchild (by ex-Shockley scientists) and then at the various "Fairchildren," such as Intel, AMD and National Semiconductors. The last example illustrates successive waves of practice and process, invention then innovation, spontaneity then structure. Of course, in this case, they led to the development of new firms, as the structures of the old proved too rigid to accommodate the ideas that their communities of practice had managed to generate.

Not all companies deal with radical ideas that call for the company to be reinvented before its invention leads to innovation. But, we want to suggest, all companies do deal with the underlying tensions between the spontaneity of practice and the structure of process. Consequently, to return to where we began, all companies tend to lurch from attempts to foster more creative and adaptive practices (implicit in the quality movement, for example) to attempts to restrain over-exuberance of practice and to harness this within process (implicit in business process reengineering). And when that becomes too restrictive, they will shift back towards practice-centered approaches (such as those found in certain theories of knowledge management).

In all, the goal is always to generate and to harness knowledge, but generating and harnessing call for different measures and management approaches, which tend to come in all or nothing form ("forget all you know" and "don't automate, obliterate" were famous war cries of the process movement). In the middle of this maelstrom of advice, managers resemble Plato's famous charioteer trying to control an unruly pair horses while each tries to pull the charioteer in the direction it favors, one forever soaring up, the other plunging

down. The manager's task is to keep the unruly team together. More often than not, however, the whole thing plunges sharply down for a while before it is reined in as excessive and everything charges upwards. In such circumstances, simple forward progress is pretty hazardous for all aboard.

Endnotes

¹ For a brief history of knowledge management, see Larry Prusak, "Where Did Knowledge Management Come From?" *Knowledge Directions* 1999, 1 (Fall), pp. 90-96. We don't wish to suggest that there were no other forces at play in these swings; the quality movement was clearly influenced by the threat from Japanese companies and the process movement by the availability of information technology.

² For more on this view of business process reengineering, see John Seely Brown and Paul Duguid, chap. 4 in *The Social Life of Information*. For a response from the reengineering camp, see Michael Hammer, "Process Makes Practice Better" CIO March 1, 2000.

³ This argument owes a great deal to a draft of Christophe Lecuyer's history of Fairchild in Chong-Moon Lee, William Miller, Henry Rowen & Marguerite Hancock, (eds.), *The Silicon Valley Edge: A Habitat for Innovation and Entrepreneurship* (Stanford, CA: Stanford University Press, forthcoming).

⁴ Dominic Gates, "The Pretext Interview: Frank Heart Talks to Dominic Gates" in *Pretext* 1998 [Online]. Available: <http://www.pretext.com/mar98/columns/intview.htm>.

⁵ Michael Hiltzik, *Dealers of Lightning: Xerox PARC and the Dawn of the Computer Age* (New York: Harper Business, 1999), p. 116.

⁶ Charles H. Ferguson. *High Stakes, No Prisoners: A Winner's Tale of Greed and Glory in the Internet Wars* (New York: Times Business Books, 1999), p. 33.

⁷ John Seely Brown & Paul Duguid, "Organizational Learning and Communities of Practice: Towards a Unified View of Working, Learning, and Innovation," *Organization Science*, 1991 2 (1): 40-58; Etienne Wenger, *Communities of Practice* (New York: Cambridge University Press, 1998).

⁸ Kenneth J Arrow, *The Limits of Organization* (New York: W.W. Norton, 1974), p. 47; Joseph A Schumpeter, *Capitalism, Socialism, and Democracy*, 3rd ed. (New York: Harper Torchbooks, 1947), p. 132.

⁹ Dorothy Leonard-Barton, *Wellsprings of Knowledge: Building and Sustaining the Sources of Innovation* (Cambridge, MA: Harvard Business School Press, 1995).

¹⁰ Jim Barksdale, quoted in Michael A. Cusumano & David B. Yoffie, *Competing on Internet Time: Lessons from Netscape and Its Battle with Microsoft* (New York: Free Press, 1998), p. 60.

¹¹ David Kearns, quoted in Erica Schoenberger, *The Cultural Crisis of the Firm* (Oxford: Blackwell, 1997), p. 185.