

Creativity Versus Structure: A Useful Tension

John Seely Brown and Paul Duguid

Management training rightly stresses the resolution of tensions and conflicts. But there are some organizational tensions and conflicts that managers shouldn't try to resolve. For example, a necessary tug of war exists between how companies generate knowledge in practice versus how they implement it through process. The tension reflects the countervailing forces that, on the one hand, spark invention, and on the other, introduce the structure that transforms those inventions into marketable products. In isolation, these forces can destroy a company, but conjointly they produce creativity and growth.

New knowledge, vital for growth, frequently emerges from small communities of practice. In other words, research groups often develop a common set of habits, customs, priorities and approaches that both produce new insights and enable them to flow with little attention to how they might be transferred to outsiders.

During the early days of Fairchild Semiconductor (the company that spawned Intel and just about every major Silicon Valley chip developer), the founders worked in overlapping groups on a variety of tasks, all of which came together to produce successful semiconductors. According to Christophe Lecuyer's history

of Fairchild in "The Silicon Valley Edge: A Habitat for Innovation and Entrepreneurship," Jay Last worked with Gene Kleiner on a step-and-repeat camera and with Robert Noyce on photographic emulsions. Meanwhile, Gordon Moore developed the aluminum process and joined Jean Hoerni and Noyce in their silicon-oxide experimentation, and Hoerni and Noyce teamed up on the integrated circuit. Shared knowledge, inherent coordination and collective understanding were necessary to make that collaborative inventiveness possible. The same chal-

lenge, approached by five separate labs within a corporation, would be more difficult (if not impossible), in part because of debilitating discussions over who does what and when.

Creative shared practice also was evident in the group that invented the computers at the heart of the original Internet. In a 1998 interview with PreText Magazine, Frank Heart recalled that "everyone 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."

Alan Kay, reflecting on the more homogeneous group that developed the graphical user interface (GUI) at Xerox Palo Alto Research Center (PARC), describes the dynamics in similar terms. In Michael Hiltzik's "Dealers of Lightning: Xerox PARC and the Dawn of the Computer Age," Kay observes, "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."

Such tightknit, innovative communities can thrive within established companies. For example, Heart's group formed within Bolt Baranek and Newman (BBN) and Kay's within Xerox. Alternatively, they can *be* the company, as in the case of Fairchild's early days.

Knowledge creation and wealth creation, however, do not necessarily move hand in hand. Knowledge may emerge in closely knit groups. Wealth comes from growth. And growth will often unravel such groups. Companies develop into distinct communities: design, engineering, software, hardware, marketing, sales and so forth. At this stage, the coordination that had been implicit becomes an explicit headache.

Once separated, groups develop their own vocabularies; organizational discourse sounds like the Tower of Babel. At Xerox, for example, when managers tried to extend the knowledge created at PARC to the rest of the company, what had been intuitive among scientists working on the GUI proved almost unintelligible to the engineers who had to turn the ideas into marketable products. Insurmountable barriers of misunderstanding and then distrust developed between the communities. The scientists dismissed the engineers as copier-obsessed "toner heads," whereas the engineers found the scientists arrogant and unrealistic. Thus one of the greatest challenges that innovative companies face is the step from initial innovation to sustainable growth.

When an organization reaches a certain stage in its development, instead of developing like a self-organizing string quartet, it becomes more like an orchestra whose disparate sections now need a conductor. At that point, establishing business processes becomes important. Process helps coordinate different communities so that their practices, while allowed to flourish, don't grow out of touch with one another. Ideally, processes must permit rigor without rigidity.

Great new ideas help only those organizations with the discipline and infrastructure needed to implement them.

Companies that fail to control the conflicting forces of practice and process at best alternate between attempts to foster creativity and attempts to exert control. At worst, they pull apart or atrophy.

That balance is not easy to achieve. Process emphasizes the hierarchical, explicit command-and-control side of organization — the structure that gets things done. By contrast, practice emphasizes the implicit coordination and exploration that produces things to do. Practice without process tends to become unmanageable; process without practice results in the loss of creativity needed for sustained innovation.

Timing is equally important. Netscape serves as an example of a company that introduced formal processes too late. The company was by most accounts brimful of bright ideas and creative groups, but it lacked the discipline necessary to take on its top rival, Microsoft. As CEO Jim Barksdale noted in “Competing on Internet Time: Lessons From Netscape and Its Battle With Microsoft,” by Michael Cusumano and David Yoffie, “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.” But because Netscape assumed for too long that its apparently greater creativity alone would defeat Microsoft, it was slow to develop business strategies to channel that creativity.

The early history of Xerox indicates how, conversely, introducing process too early may restrict inventiveness. Hoping to harness a profusion of ideas and an explosion of growth that accompanied the development of the 914 copier (well before the creation of Xerox PARC), the board of directors brought in new management from Ford Motor Co. But, as later Xerox president David Kearns recalls in Erica Schoenberger’s book, “The Cultural Crisis of the Firm,” the managers screwed down the clamps of process so tight that, for a time, they stifled a highly creative company.

Aware that process can be suffocating — and seeking to foster creativity outside a process-driven structure — corporations often try to loosen the ties that bind them. AT&T’s Bell Labs, Lockheed’s Skunkworks, General Motors’ Saturn plant and Xerox PARC all reflect attempts at such loosening. These experimental “sandboxes” try to provide a safe environment for knowledge creation. But they too easily isolate new practices from essential process. Consequently, reintegrating ideas back into the organization can be remarkably difficult. So, for example, the knowledge that had flowed easily within PARC did not flow across its borders to the rest of the corporation.

Of course, many of the ideas created at PARC ultimately did align themselves with productive processes: the precursors to the PC, the mouse and Windows interface, to name a few. But because

profoundly different practices separated the research groups within Xerox, the ideas flowed outside to Apple Computer, Adobe Systems, and Microsoft — companies that had better processes in place for turning such embryonic concepts into products. Similarly, the ideas created at Bell Labs made the trek to Shockley Semiconductor, while the Shockley-developed semiconductor trekked first to Fairchild and then to various “Fairchildren,” such as Intel, Advanced Micro Devices and National Semiconductor. In those examples, existing companies were unable to create the processes needed to take advantage of new ideas, so new companies formed.

Companies that fail to control the conflicting forces of practice and process at best alternate between attempts to foster creativity and attempts to exert control. At worst, they pull apart or atrophy. Practice shuns process, and vice versa. In contrast, productive companies yoke the two forces together, seeking — to borrow a phrase explored by knowledge and innovation specialist Dorothy Leonard — “creative abrasion.” In our examples, however, the abrasion comes not between different cognitive styles, as Leonard suggests, but between practice (which tends to follow the path of least resistance) and process (which tries to map a route). In trying to harness the two forces, managers resemble Plato’s famous charioteer struggling to control an unruly pair of horses while each tries to pull in the direction it favors — one forever soaring up, the other plunging down. We have all seen the wild swings that come as each horse gets its head in turn: from quality to reengineering, from reengineering to knowledge management, and so on. The best-managed companies are those that can maintain forward progress, favoring neither practice nor process, but managing both.

John Seely Brown is chief scientist of Xerox and chief innovation officer of 12 Entrepreneurship in San Francisco. Paul Duguid is a research specialist at the University of California, Berkeley. Contact the authors at jsbrown@parc.xerox.com and duguid@socrates.berkeley.edu.

Reprint 42410

Copyright ©2001 by the Massachusetts Institute of Technology. All rights reserved.