

The Social Life of Innovation

Fostering a change of practice in a community is much more difficult than inventing a new technology. The practice of innovation can be learned—once you know what it is.

Innovation is one of the most celebrated aspects of technology. Business leaders consider innovation a core competency, the only way to assure marketplace strength for lean organizations. Popular technology magazines annually venerate top innovators with special articles and profiles. Books on innovation—for example, *The Innovator's Dilemma* [2], *Creative Destruction* [5], and *Value Migration* [9]—are frequent bestsellers. Our computing graduates have been steeped in stories of computing technologies that changed the world—and many dream of one day doing likewise. Considering these circumstances, I cited innovation as one of computing's core practices; a practice without which one cannot be a complete professional (see my November 2003 column).

Many organizational leaders speak of their desire to establish a “culture of innovation.” They mean: without special urgings by leadership, everyone in the organization is busy finding ways to help customers (and themselves) improve their practice. A culture of innovation cannot be achieved without cultivating personal prac-

tices of innovation throughout the organization. What are these practices? What must one learn to become a skilled innovator? How

can teachers help those who seek the skill? This column suggests answers to these questions.

Innovation versus Invention

The word innovation has been used to mean either new ideas or new practices. Since ideas have no

impact unless adopted into practice, I use innovation to mean the adoption of a new practice in a community. Innovation is therefore a social transformation in a community.

I draw a sharp distinction between innovation and invention. Invention means simply the creation of something new—an idea, an artifact, a device, a procedure (see [6–8] for recent examples). There is no guarantee that an idea or invention, no matter how clever, will become an innovation. Preserving the distinction is crucial because, as will be discussed shortly, the practice of innovation is not a practice of inventing.

Innovation requires attention to other people, what they value and will adopt; invention requires only attention to technology.

Bob Metcalfe, the inventor of Ethernet, speaks of this distinction colorfully. In a 1999 interview, his interlocutor exclaimed, “Wow, it was the invention of the Ethernet that enabled you to buy your house in Boston's Back Bay!” Metcalfe responded: “No, I was able to afford that house because I sold Ethernets for 10 years!”

Although business innovations get the lion's share of attention,

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innovation in fact occurs in all kinds of organizations and communities. And it occurs at all scales from a handful of people adopting new practice, to billions of the human populace.

The term innovation also refers to the discipline and practice of innovation—the work of innovators.

Innovation can be carried out systematically and its principles taught. Success is not a matter of psychology, charisma, inspiration, talent, or flash of genius; it is a matter of education.

The remainder of this column is about the practice of innovation. If you are not concerned about selling your ideas or seeing them through to practice, the following will be of limited interest to you.

Innovation as a Discipline

In 1985, Peter Drucker published the definitive work, *Innovation and Entrepreneurship* [4]. He focused on two main aspects: The practice of innovation—the innovator searches for opportunities and transforms them into a new practice in the marketplace; and the practice of entrepreneurship—institutional ways and processes embed the practice of innovation into an organization. He analyzed

Searching for opportunity	Noticing an opportunity in one of the eight innovation sources.
Analysis	Developing a project or business plan, identifying costs, resources, and people, analyzing risk and benefits.
Listening	Going out into the community, listening for concerns, finding what they are receptive to; adapting the proposal to match.
Focus	Developing a simple articulation of the central idea and sticking to it despite temptations to embellish or extend prematurely.
Leadership	Positioning the technology to be the best of breed; mobilizing people and market for it.

Table 1. Elements of the process of innovation (source: Drucker [4]).

a large number of cases to reveal the five elements of the process of innovation (see Table 1). Drucker wrote his book after working 30 years with innovators. The dot-com bust 15 years later might

Unexpected events	Unexpected successes or failures; outside events.
Incongruities	A gap between reality and common belief; aspects that do not fit together.
Process Need	A bottleneck in a critical process.
Change of industry structure	New business models, distribution channels, modes of business.
Demographics	Changes in groups by age, politics, religion, income, and so on.
Change of mood or perception	Change in the way people see the world (for example, post-9/11 terrorism), of fashion, convention, and so on.
New knowledge	Application of new knowledge, often involving scientific advances and convergence of different areas.
Marginal practices	Fringe practices that may resolve persistent breakdowns in current central practices.

Table 2. Opportunities for innovation (sources: first seven, Drucker [4]; last, Spinoza et al. [10]).

have been avoided if the leaders of the new ventures had all read it.

Drucker devoted over half his book to the search for opportunities, which he grouped into seven categories or sources (see Table 2). The whole point is to look for opportunities in breakdowns, problems, changes, and chal-

lenges. The first four sources normally appear internally as challenges to the operation of the business; they can be pursued without the pressure of external competition. The next three sources appear externally, as part of the context in

which the firm does business; they are complicated by competition with other firms. The eighth source, marginal practices, is adopted from Spinoza et al. [10]. A marginal practice is an existing practice in another field that may appear irrelevant in yours, but

offers an opportunity to solve your problem. Hypertext, for example, was a marginal practice in computing until Tim Berners-Lee transformed it into a central practice of the Web.

Drucker warns that innovating by applying new knowledge is a special challenge. It is the most risky, has a

long gestation period, depends on precise timing within a narrow window of opportunity, has numerous competitors, and relies on a convergence of two or more knowledge areas. Even though it is not the only source of innovation, new knowledge gets the most attention.

Drucker says the iconic risk-taking entrepreneur is a myth: successful entrepreneurs engage in

the five-part process, which actually reduces their risk. He also maintains that bright ideas are not innovations; without the other four parts of the process, they lead nowhere.

Personal Foundational Practices of Innovation

For the past 10 years I have been teaching engineering students the personal foundational practices of innovation [3]. I have read innova-

are components of “leadership action.” Note also that these skills support “marketing,” at which most successful innovators excel.

These practices support Drucker’s process. For example, in searching for opportunities, the innovator needs a heightened sense of awareness to be able to actually see them. The central challenge is to overcome “cognitive blindness,” a condition where we can’t see something and we

practices are primarily social, not technical. This is because the primary work of innovation is seeing something missing for other people, defining a new approach, and working with them toward adoption and acceptance. Technical innovations require the innovator to be skilled in both the social dimension as well as the technical; one or the other will not do. It is indeed true that innovation has a social life!

Awareness	Ability to perceive opportunities and concerns, distinguishing them from your own agenda and concerns; ability to overcome cognitive blindness.
Focus and Persistence	Ability to maintain attention on the mission and avoid distractions; holding to the mission amidst chaos, challenge, or opposition; refusal to give up in the face of obstacles and challenges to the mission.
Listening and Blending	Listening for deeply held concerns and interests and adapting actions to fit (“finding the win-win”)
Declarations	Ability to make simple, powerful, moving, eloquent declarations that create possibilities and open attractive new worlds for others.
Destiny	Operating from a sense of a larger purpose than yourself; the purpose drives you.
Offers	Making and fulfilling offers that bring services, practices, or artifacts of value to your customers; organizing groups and managing their commitments toward delivery of the results; maintaining a deep commitment to doing whatever is needed to obtain the results.
Networks and Institutions	Gathering allies, defending against objectors, and creating institutions to further the innovation, develop common standards, and widen its acceptance.
Learning	Making time to learn new skills, acquire new knowledge; making well-grounded assessments in preparation for new learning and action.

Table 3. Personal foundational practices of innovation.

tors’ stories, talked to them, and watched them carefully, looking for the common patterns in their behavior: I have found eight, as shown in Table 3. The innovation process is unlikely to work if attempted by practitioners who lack these practices.

Note that declarations and destiny are closely related, and that offers, networks, and institutions

can’t see that we can’t see it. Collaborations with other people, especially those of markedly different views or from different communities of practice, can be especially helpful to overcoming cognitive blindness. As another example, the innovator needs to focus on the simple core of the innovation; it takes practice to articulate the essential core and discipline to resist distractions and embellishments.

The personal foundational

The World Wide Web: A Case Study

Tim Berners-Lee, inventor of the World Wide Web and director of the WWW Consortium (W3C), has written his story about the development of the Web and where he thinks it is going [1]. His book is a rare opportunity to examine a contemporary innovation in detail from the perspective of the person who masterminded it.

Berners-Lee’s invention was a Web browsing system on a NeXT computer circa 1990. This system included HTML, a new markup language for documents containing hyperlinks, HTTP, a new protocol for downloading an object designated by a hyperlink, URL, a scheme for global Internet names, and a graphical user interface. Berners-Lee engineered a convergence among these technologies by drawing upon well-known ideas and practices, including Gopher (the University of Minnesota’s file fetching system), FRESS and ZOG (hypertext doc-

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ument management systems), SGML (the digital publishing markup language), TCP/IP and FTP (standard Internet protocols), operating systems (the global identifier concept of capability systems), and Usenet news and discussion groups. Some say this invention is not remarkable. What is remarkable is the innovation that came from it. How the seven foundational practices helped the inventor of the Web turn it into an innovation is explored in the following paragraphs.

Awareness. Berners-Lee knew from his conversations with people that many in the 1980s felt the Internet was not moving toward its ultimate promise. It was good for email and limited file sharing, but data incompatibilities and clumsy protocols impeded productive collaboration. He concluded that hypertext would be an enabling technology for collaboration and advancement of global knowledge, envisioning a universal hypertext linking protocol for all Internet computers. At the time, hypertext was a marginal practice in computing, essentially ignored except in a small, vigorous research community. Rather than write research papers about this possibility, he looked for process needs at CERN (his employer) that could be solved by hypertext linking. He found that document sharing among internal scientists and with their external collaborators was a hot issue within CERN and in 1989 he wrote a proposal

for a document sharing system based on hyperlinks. This became his avenue for transforming hypertext to a central practice of the Internet.

Listening and Blending. Berners-Lee was taken aback when key individuals did not respond to his proposal, even after he modified it on advice of colleagues who understood the decision-making process. He did not give up. He talked to various people who might be prime users of his proposed technology. He saw ways the technology would help them—for example, giving access to the CERN phone book and to news and discussion groups, or sharing research papers within the high-energy physics community. Through his willingness to blend his ideas with those of his colleagues, he gradually enlisted allies. His ability to listen and blend was key to his ultimate success.

Focus and Persistence. Once Berners-Lee received approval in 1990 to start an implementation, he never wavered from a small set of simple guiding principles: no single controlling authorities, universal identifiers, the markup language HTML, and the protocol HTTP. These principles were realized in his browsing system. He steadfastly maintained they were the essence of the Web; all else would be a distraction. He resisted all efforts to complicate the basic system. He analyzed all new proposals to make sure they were true to these principles.

Declarations and Destiny. Berners-Lee was not afraid to make

bold declarations about the kind of world he would like to see evolve under the influence of the Web. His declaration of simple, basic elements became a powerful gathering force. Every chapter of his book is pervaded with a sense of a larger purpose behind his declarations—world intelligence, global learning, social good, economic development, advancing developing countries, reducing world tensions. He declined his friends' urgings to start an Internet company and become wealthy from his own invention because he felt he could not accomplish the mission by wavering from his commitment that all the Web software be in the public domain, free for anyone to use without license.

Learning. Berners-Lee did most of his learning by visiting people, listening to their ideas, and seeing their technology.

Leadership Action. Berners-Lee is a man of action. He accomplished his innovation by making offers, building alliances, and creating institutions. His 1989 proposal was his initial offer. He made critical alliances—Robert Cailliau at CERN helped work the political system at CERN, and Michael Dertouzos at MIT helped establish the W3C, modeled after the successful MIT X Windows consortium. He visited with many people to promote his idea and look for ways to help them achieve their own goals by getting involved. He recruited great programmers to build the prototypes. He campaigned tire-

lessly to get people to build browsers that could be run on all major platforms; Netscape was the first commercial browser. He leveraged the hypertext community by giving the first public demonstration of the Web at one of their conferences; they were the first to establish Web sites.

When various commercial interests started jockeying to control the technology, Berners-Lee established the W3C to provide a forum for improving and evolving the Web through consensus. With help from powerful allies at MIT, CERN, and INRIA he eventually recruited 450 major companies to join the consortium. He insisted that the consortium abide by the principle of non-control: they develop and promulgate non-binding recommendations, which like the Internet RFCs have become de facto standards.

Ilkka Tuomi wrote his own account of the Web, the Internet, and Linux [11]. He reaffirms that the leaders of those innovations understood they were working for a social change and not just inventing a new technology.

What It Means For You

To be an innovator, you must understand the process, the opportunities, and the foundational practices. A reading program will help to better understand the process of innovation. Read Drucker. Read accounts of particular innovations (for example, Berners-Lee and Tuomi): do you see Drucker's model at work? Have some inno-

ventions succeeded without following all five steps? Have some used steps not discussed by Drucker?

Use a journaling practice to train yourself to be an observer of opportunities and a listener of concerns. Regularly record opportunities for innovation that you became aware of. Record your impressions of what people you talked to care deeply about. Record how you overcame cognitive blindness by collaborating with co-workers, especially those of different perspectives.

Learning the personal foundational practices is more difficult. Here you will need a coach or teacher who can show you how to build your awareness, make and embody declarations, maintain a focus, discover a sense of destiny in what you care about, formulate action plans, make offers, and complete actions. Many people have found that a daily meditation practice helps train their ability to focus.

Don't get discouraged by these misconceptions:

- *Innovations must be big.* In fact, an innovation can occur in a small group. Most skilled innovators first learned to make small innovations and increased their scope as they got better at it.

- *Innovations are the work of a few gifted people.* The celebrity innovators are too few in number to account for all innovations. Most innovations come from unheralded people doing their jobs. Anyone can learn the innovation practice and become skilled at it.

- *Innovations depend on novel ideas.* New knowledge, such as is generated in universities and research labs, is one of eight sources of innovation, and is often the riskiest. The other seven sources can be treasure troves of opportunities.

- *Innovations occur only in commercial markets.* Innovations occur in communities of all sizes, in business, government, education, and non-profit sectors.

As you increase your mastery of these practices, you will find yourself making more and bigger innovations. **G**

REFERENCES

1. Berners-Lee, T. *Weaving the Web*. Harper Business, 2000.
2. Christenson, C. *The Innovator's Dilemma*. Harvard Business, 1997.
3. Denning, P. The somatic engineer. In R.S. Heckler, Ed., *Being Human at Work*, 2003, 133-143.
4. Drucker, P. *Innovation and Entrepreneurship*. Harper Business (1993). (First published by Harper Perennial in 1985.)
5. Foster, R. *Creative Destruction*. Currency, 2001.
6. Hawn, C. If he's so smart... *Fast Company* (Jan. 2004), 68-74.
7. McKie, S. Let innovation thrive. *Intelligent Enterprise* 7 (Jan. 2004).
8. Sahin, K. Our innovation backlog. *Technology Review* (Jan. 2004), 56-57.
9. Slywotzky, A. *Value Migration*. Harvard Business School Press, 1995.
10. Spinoza, C., Dreyfus, H. and Flores, F. *Disclosing New Worlds*. MIT Press, 1997.
11. Tuomi, I. *Networks of Innovation*. Oxford Press, 2003.

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