Skills for Success in Engineering and Beyond: Getting Your Ideas Adopted

by **Dr. Peter J. Denning,** *New York Xi '64*

Have you ever felt frustrated when your good ideas do not get adopted and other people's bad ideas do? Or when you see so much of your effort to systematically generate new ideas go to waste? Do you want to improve your innovation success rate?

You can eliminate most of the frustration about getting your ideas adopted by choosing eight practices for your work and life.

Many engineers fret and fume over these questions. They are not alone. These questions bother most innovators.

Moreover, they are important questions. Many people believe innovation is the key to economic development, technological progress, competitiveness, and business survival. Policies that enhance a nation's ability to be innovative are constantly in public discussion and are hot topics among politicians and business leaders.

I have been investigating these questions for many years and have learned many things that I wish I knew when I was a younger engineer. My colleague, Robert Dunham, and I wrote a book, *The Innovator's Way* (MIT Press, 2010, *innovators-way.com*). I will share here some excerpts from the book. I think you will find them useful every time you have an idea you would like to see adopted.

Meaning of Innovation

Innovation is one of the most studied subjects of all time. The number of book authors in the area is truly amazing—Amazon.com lists 9,300 books with the word innovation in their titles. Two things are remarkable about this literature:

- There is not a lot of agreement on what innovation is. The most common notions are that innovation is a mysterious talent, a disposition of some people's DNA, a process that can be managed by savvy managers, or a flash of genius. Thus, the recommendations of different authors lead in conflicting directions.

- Positive results are few and precious. Business surveys reveal that only approximately four percent of innovation initiatives meet their financial objectives. Patent office statistics show that only about 0.2 percent of patents make a return on the inventor's investment. The National Research Council reported in 1986 that the government's track record of promoting innovation through university research is not as good as is commonly believed—fewer than 25 percent of innovations are connected to published research ideas.

It appears that we collectively share a misunderstanding of innovation and, therefore, experience great difficulty in achieving it. Our methods are ineffective.

The low success rate of innovation initiatives is often explained as an inevitable consequence of the uncertainty of innovation. We are often asked to rejoice that our success rate is so high. If low success is certain, a company's best strategy is to *take many shots on goal*. However, this strategy is available to only a few companies that can afford to let 96 percent of their research and development go to waste. For the rest of us, achieving innovation looks like a crapshoot.

My co-author Bob and I do not accept this explanation. We have observed numerous people—we call them the serial innovators—who get their innovations adopted, over and over again, with success rates much higher than four percent. What can they teach us?

By studying and interacting with them, we learned that innovation is a skill. The skill consists of eight mostly conversational practices that are easy to explain and can become second nature through practice. Individuals, teams, organizations, and networks that embody these practices are regularly successful with their innovation initiatives.

Innovation Defined

Bob and I realized that if we are to teach and coach innovators, we need a clear, observable definition of the outcomes produced by skillful innovators. Proposed definitions based on notions like *DNA disposition* or *flash of genius* do not meet this requirement. We decided on a definition that is the acid test of successful innovation:

Innovation is adoption of new practice in a community.

There are three key words in this definition:

1. *Community.* The set of people who change. The community can be small such as a family, medium such as a firm's customers, and large such as a nation or the world.

2. *Practice.* Habits, routines, and processes that people embody. Embody means they engage with the practice skillfully and without conscious thought. The ability to perform is not the same as applying a mental concept.

3. *Adoption.* The members of the community make a commitment to learn and embody a new practice. They will make such a commitment only if they see sufficient value in the new practice and are willing to sacrifice the previous practice to get it.

Table 1. Structure of the Innovation Practices

The main work of invention	1	Sensing	Locate and articulate a new possibility, often in disharmonies or incongruous events
	2	Envisioning	Tell a compelling story about the world when the possibility is realized
The main work of adoption	3	Offering	Offer to produce the outcome; gain a commitment to consider it
	4	Adopting	Gain commitment to try for the first time, and overcome resistance to the change
	5	Sustaining	Gain committee to stick with the new practice over time, integrating it into the environment
The environment for the other practices	6	Executing	Create environment for effectively managing all commitments to completion
	7	Leading	Proactively mobilize people to generate the outcomes of the other practices
	8	Embodying	Instill the new practice into the practices of the community

Notice that this definition covers many types of innovation. The Internet is a set of technologies that support new practices including browsing, searching, online shopping, social networking, blogging, and texting. Mothers Against Drunk Driving inspired new practices backed by laws to take drunk drivers off the roads. Sustainable architects have introduced new construction practices that produce buildings with no carbon footprint. Heads of families have adopted small business practices to help them balance income and expense and pay off debt. The key to success is adoption of practices, not the invention of ideas.

Unfortunately, the notion that innovation comes from clever ideas is enshrined in popular mythology. It is certainly true that ideas are necessary for innovation, but, as we will discuss, ideas are never sufficient. Company or public policies aimed at stimulating creativity, producing more ideas, or encouraging inventors do a disservice by getting everyone to focus too much on ideas at the expense of adoption. We call this imbalance the invention myth—the belief that invention of new ideas is the key to innovation. The invention myth has led many people down the path to failure in their innovation initiatives.

Then, what is a balanced and holistic view of innovation? The *Eight Ways* framework is our answer.

The Eight Ways Framework

The eight ways are practices that produce eight essential outcomes for innovation. Their names are listed on the wheel of Figure 1. Taken together, these practices define what it means to be a skillful innovator.

The wheel diagram suggests that the practices are not performed sequentially in numerical order. Instead, the innovator moves constantly among them, refining the results of earlier ones after seeing their consequences. It is better to think of the practices being done in parallel. That is why they must be learned as skills. The innovator must be able to do them well without thinking about them.

Figure 1. The Eight Ways depicted as a wheel.

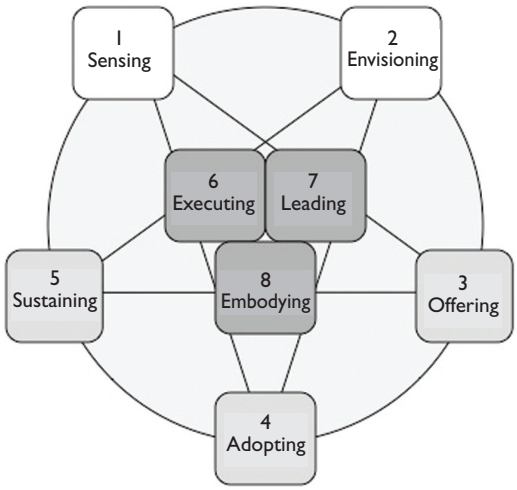

Table 1 provides more detail about the practices. The first two practices are the main work of invention, and the next three the main work of adoption. Although these five tend to be done sequentially, they are, as noted previously, not strictly sequential. Each of the final three creates an environment for effective conduct of all the other practices. The environment is important: the innovator has to execute the innovation commitments, proactively promote the innovation, and be sensitive to how other people listen and react.

The specification of each practice has two parts. The anatomy describes the structure of the practice when it goes well and produces its outcome. The characteristic breakdowns are the most common obstacles that arise in trying to complete the practice. The innovator moves toward the desired outcome and copes with breakdowns that may arise. The breakdowns are not mere annoyances. Coping with them is a normal part of the process.

Example: The World Wide Web

Tim Berners-Lee is widely known for creating the world wide web—*www*—considered one of the great innovations of the 20th century. His parents were both part of the Ferranti Atlas project in England at the University of Manchester in the 1950s. After earning a graduate degree in physics in 1976 from Queen's College, Oxford, he worked as a software engineer at Plessey Systems, a telecommunications company, and then at DG Nash, where he wrote text-processing software for intelligent printers and a multitasking operating system. Berners-Lee was fascinated by a question, first raised by his father, of whether computers could be used to link information rather than simply compute numbers. He went to CERN, the European high energy physics research laboratory, in 1980 with this question on his mind.

Berners-Lee saw a huge disharmony between the actual direction of the Internet and the information-sharing visions

of its pioneers in the 1960s. He felt a burning desire to do something about it. Given his dream about information sharing through linking, the esoteric world of hypertext was an obvious place to look for a key to an information-sharing internet.

In his spare time, he worked on a program called Enquire that could link information on any computer with any other. He began to envision CERN not as a network of separate computers, but as a single information space consolidated across many computers. In 1989 Berners-Lee wrote *Information Management: A Proposal* to create a hypertext system at CERN linking all its computers and documents into a single web from which information could be quickly retrieved from anywhere in CERN. At first his proposal was ignored, but, with help from Robert Cailliau, he gained the attention of CERN's leadership. In 1990 they gave him the go-ahead to make a prototype, which he built on a NeXT computer.

The prototype included HTML, a new markup language for documents containing hyperlinks, HTTP, a new protocol for downloading an object designated by a hyperlink, URL, an internet-compatible scheme for global names, and a graphical user interface. Berners-Lee drew on well-known ideas and practices including Gopher (University of Minnesota's file-fetching system), FRESS and ZOG (hypertext document management systems), SGML (the digital publishing markup language), TCP/IP and FTP (standard internet protocols), operating systems (the global identifier concept of capability systems, which had been on the Plessey computers), and Usenet news and discussion groups.

He posted the first web page at CERN in November 1990. Berners-Lee released and tested browser prototypes at CERN in 1991. He gave his first external demonstration at the 1991 Hypertext research conference, a natural audience for this idea. It was an immediate success and inspired others to build websites. The first non-CERN website went up at the Stanford Linear Accelerator Center in December 1991. Websites began to proliferate; there were 200 in 1993. With the universal free browser Mosaic released by Marc L. Andreesen at the University of Illinois at Urbana-Champaign in 1993, the WWW took off exponentially. During the 1990s, many new industries formed including e-commerce (selling by online stores via web interface), publishing, digital libraries, eBay, Google, Amazon.com, Yahoo, and the internet business boom (and bust).

Berners-Lee had no master plan, business plan, or any other formal document outlining a strategy for the web. Instead, he insisted that all programmers working on web software adhere to a small set of simple core principles: openness to everyone, no single controlling authority, universal identifiers, a markup language HTML, and a protocol HTTP. He steadfastly maintained that these principles were the essence of the WWW—all else would be a distraction. He analyzed all new proposals to make sure they were true to these principles.

Building political support for the web while advancing the web technology became Berners-Lee's central passion. Robert Cailliau helped him build support within CERN. In 1994, he worried that commercial companies might get into a competition over who owned the web, in violation of his core principle of openness. Michael L. Dertouzos *[Massachusetts Beta '64]* at MIT helped establish the World Wide Web Consortium, W3C, modeled after the successful MIT X Windows consortium. This consortium eventually attracted more than 400 companies, which collaborated on development of web standards and tools; it became an engine of innovation for the web. The W3C was an open-software, consensus-based organization that issued non-binding recommendations. The recommendations became *de facto* standards after consortium members adopted them.

He himself refused to set up a private company so that he could benefit financially from his technology. It belongs to the world, he said.

Here is a summary of how Berners-Lee engaged the eight practices:

Sensing

In the 1980s, he saw a disharmony between the actual direction of the Internet (email and file transfer) and its promise (semantic web of all human knowledge). This bothered him. It moved him to do something about it.

Envisioning

He envisioned a system of hypertext-linked documents; any one could link to any other. Mouse-clicking a link would cause the system to retrieve the target document. The system architecture would consist of HTTP, HTML, URLs, and a browser. Common tasks such as scheduling meetings, looking up citations, and getting mail and news would be easy in this system.

Offering

In 1989 Berners-Lee offered to build such a system at CERN. At first his offer was spurned, but with advice from colleagues he reformulated his offer around CERN document-retrieval needs and got permission to build a prototype on a NeXT machine. He demonstrated the prototype at the 1991 Hypertext research conference, got strong positive responses, and solicited implementations of web servers.

Adopting

He visited many sites and attended many conferences to tell people about his system, always soliciting new servers, software, and browsers. Marc L. Andreesen, a student at the University of Illinois at Urbana-Champaign, co-authored and made Mosaic the first universal, easy-install graphical browser in 1993. After that users adopted the web like wildfire.

Sustaining

In 1994, Berners-Lee founded the World Wide Web Consortium, hosted by MIT and CERN, to preserve the web in the public domain by creating open software and standards for the web. Over 400 organizations eventually joined W3C, and it became an engine of innovation for the web.

Executing

He put together programming teams and solicited others to do the same, so that good web software was developed and made available for anyone to use. He set clear principles for design and implementation of all web software.

Leading

At every opportunity, he recruited ever-larger numbers of followers and web supporters. Berners-Lee articulated a small set of guiding principles for web development and stuck with them. He refused to let the web "go private" or to become wealthy from his own invention. He said the cause was too important and too big for his personal considerations to influence.

Embodying

He embodied his set of core principles for the web and practiced them everywhere he went. Through well-designed software and later through tutorials in the W3C, he helped web users to embody the new practices of linking, clicking, and browsing.

Extension to Teams, Networks, and Organizations

The eight ways have been presented as personal skills. They are the skills of serial innovators who are good at all eight.

But what happens if you are strong at several but not all? For example, you could be a good inventor and storyteller, but you dislike anything having to do with offering or adopting. The obvious thing to do is team with others who are good at the practices you do poorly. With effective coordination, the team as a whole can do all eight practices and be positioned for success at its innovations.

The same is true at a larger scale for organizations. A well-designed organization can have people skilled in all the practices and, with good internal coordination, it can become very successful at innovation.

Networks can also be very good at innovation, if they have people who are good at each of the practices and use the network as a means to find each other and coordinate. Open source software communities, such as the W3C, illustrate this.

In all cases, the eight practices are embodied in the innovative individual, team, organization, or network. The eight practices must always be present in order for individuals or collectives to be successful at innovation.

Self Assessment

The eight-practices framework is not only a guide to practice, it is a useful assessment tool. With it, we can gauge our relative strengths and our chronic weaknesses in the practices. A simple version of the detailed procedure in the book is presented below. Make a list of the eight practices, and score yourself from 1 (weakest) to 5 (strongest) on each as follows:

1. *You are not aware of the necessity of this practice.*
2. *You are aware, but have taken no actions to improve your performance of this practice.*
3. *You are taking actions to improve your performance.*
4. *You are satisfied with your performance.*
5. *You are masterful at your performance.*

To have reasonable prospects of success at your innovations, you need a score of 3 or more on all eight practices. Most people with weaknesses have multiple weaknesses. Strengthening your performance in just one practice won't significantly improve your success at innovation. The book gives plenty of details.

The same assessment process can be applied to a team or organization. You just ask how effective is the team as a whole. Similar to individuals, weak teams tend to have multiple weaknesses. Getting the big picture is essential to improving your success at innovations.

Conclusions

Innovation is the adoption of new practice in a community. It is not a mysterious talent, a product of good DNA, a management process, or a flash of genius. It is the outcome of an innovator—individual or team—skillfully performing the eight practices. The eight practices share four main features:

- *They are fundamentally conversations.* Innovators perform them by engaging in the right conversations.
- *They are universal.* Every innovator, and every innovative organization, engages in all of them in some way.
- *They are essential.* If any practice fails to produce its outcome, the entire process of innovation fails.
- *They are embodied.* They manifest in bodily habits that require no thought or reflection to perform.

With these practices, you can take charge. You have the power to transform your ideas into adopted practice. The eight practices are the way.

Dr. Peter J. Denning, *New York Xi '64,* is distinguished professor of computer science and director of the Cebrowski institute for information innovation at the Naval Postgraduate School in Monterey, CA, and is a past president of the Association for Computing Machinery. After receiving his B.E.E. at Manhattan College, he went to MIT, where he earned an M.S. in 1965 and his doctorate three years later. His work at Princeton and Purdue Universities was followed by eight years at NASA Ames Research Center and 11 years at George Mason University before joining the NPS in 2002. *pjd@nps.edu*