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Mack Center
for Technological Innovation

Wharton
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The Changing Face Of Innovation:

Next Challenges For Practice

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The Changing Face of Innovation: Next Challenges for Practice

Mack Center for Technological Innovation at The Wharton School
The University of Pennsylvania
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CONFERENCE EXECUTIVE SUMMARY

Innovation as a management discipline is changing. Global forces have redirected the nature and location of innovation. Research productivity appears to be declining in many established sectors while flourishing in emerging markets. Meanwhile, the pace of technological change is accelerating, uncertainty remains unabated, and advances in organizational innovation continue to raise expectations among consumers, investors, and societies at large. The June 3, 2011, Mack Center conference addressed the concept of meta-innovation (i.e., making innovation itself more innovative) from a broad perspective, to help understand the deeper forces driving these changes with an eye to the future. Each speaker provided a unique vision of how to create and manage sustainable innovation at the enterprise level.

It has never been more important to innovate, nor perhaps has it ever been more difficult. As **Roger Martin** observes, up to 80% of managers are dissatisfied with the level and pace of innovation at their companies. Is becoming an innovative company as easy as creating a "Chief Innovation Officer" or an innovation department, or does innovation arise as if by chance from the social and human networks within companies and industries? **Jeff Dyer** explained how utilizing creativity and the "five basic discovery skills" can help you build an innovative company. **Rob Cross** discussed how to analyze the informal networks already in place at your company and how to get the most out of them. However you decide to tackle the challenge of innovation—and, as **Paul Schoemaker** explained, there are many ways to innovate—being the leader of an innovative company takes courage, the willingness to take risks, and the ability to learn from mistakes.

Innovation does not exist in the proverbial lab anymore, where somewhat serendipitous "aha" moments "just happen," according to **Sid Winter**. Rather, innovation exists in a delicate ecosystem where companies develop their unique dynamic capabilities to transform new ideas into beneficial products and services.

What separates innovation today from 50 years ago is the Internet. Innovation today occurs in the digital environment—meaning that ideas can be captured in real time, anywhere in the world. Researchers or collaborators no longer need to be located in the same physical location. Partnerships are no longer bound by proximity. Outsourcing is becoming a partnership rather than a transactional process. The new currency in this digital environment, according to **John Seely Brown**, is knowledge. Thus, creating an atmosphere where knowledge networks circulate know-how within the lifeblood of a company is an invaluable step toward innovation.

The challenge of simultaneously meeting your budget and innovating is a sticking point for many corporate managers. Overcoming the tyranny of the budget is one of the riskiest aspects of innovation. The standard business model requires managers to "prove" a project will be profitable before it will be funded. Getting comfortable with "maybe" and trial and error represents a vital change in thinking when creating an environment conducive to innovation. Meeting the challenges of globalization, uncertainty, and rapid technological change in the future will require companies to harness their internal knowledge networks while also partnering with best-in-class vendors.

Perspectives on Innovation

Paul J.H. Schoemaker

Innovation isn't just about products anymore, and it's not confined to a laboratory. It's become part of a company's bloodstream, yet no two companies approach innovation in the same way. Tools for managing innovation abound, but bridging a theory of innovation to its day-to-day practice involves risk, mistakes, and failure. How do you overcome the constraints of a budget to try out a new process, product, or market space? Which projects do you fund, and which ones do you ignore? How do you pick the winners from the losers when considering a new product, service, or process? Finally, the biggest gap to bridge when implementing innovation is convincing your senior management and investors to fund these more risky ventures. Dr. Paul Schoemaker, Research Director of the Mack Center for Technological Innovation, looked back at the past 50 years of innovation and invited audience comments during his June 3, 2011, talk, "Perspectives on Innovation" at the Mack Center conference, The Changing Face of Innovation.

LOOKING BACK TO SEE AHEAD

What's different about innovation now than in 1960? "The whole concept of innovation has a broader conceptual matrix today," Schoemaker said. "Innovation exists along many dimensions; it's not just about new product innovation and processes—it's a broad spectrum." Advances in telecommunications, as well as collaboration, globalization, and even deregulation have had the biggest impact on how companies innovate today compared with five decades ago, he said. Historically, companies were focused on inside-out innovations, where they kept building on their existing products and core competencies to develop new products. "Today the goal is to create a context that allows good things to happen," Dr. Schoemaker said. "But you don't want to overdo it. If you do, you may kill the thing you are trying to create."

A SPECTRUM OF STRATEGIES

At one extreme is the inside-out approach, where a company continually builds on its existing products and adds incremental improvements. Procter & Gamble has been a great example throughout its history. The company started out selling wax candles and built an extensive portfolio of consumer products based on using innovation to identify and address unmet needs. At the other extreme, Schoemaker noted, is Google's "quantum innovation" approach. This model starts with a broad sense of purpose, such as organizing the world's knowledge or raising the world's IQ, and involves finding smart people to help pull it off. Google's structure is flat and transparent, and about 20% of each budget is flexible, Schoemaker explained. "Google frames its strategy around creating a portfolio of options called Googlettes. Many of these projects may

have a low probability of success and can cost as much as $1 billion, but if they win, they really win BIG," he said, adding that this approach goes against the more standard method of calculating net present values to assess expected returns. "You need to overcome the forces of the status quo if you want to emulate Google's quantum approach. You have to be willing to challenge the mental models that prevent people from seeing breakthrough solutions."

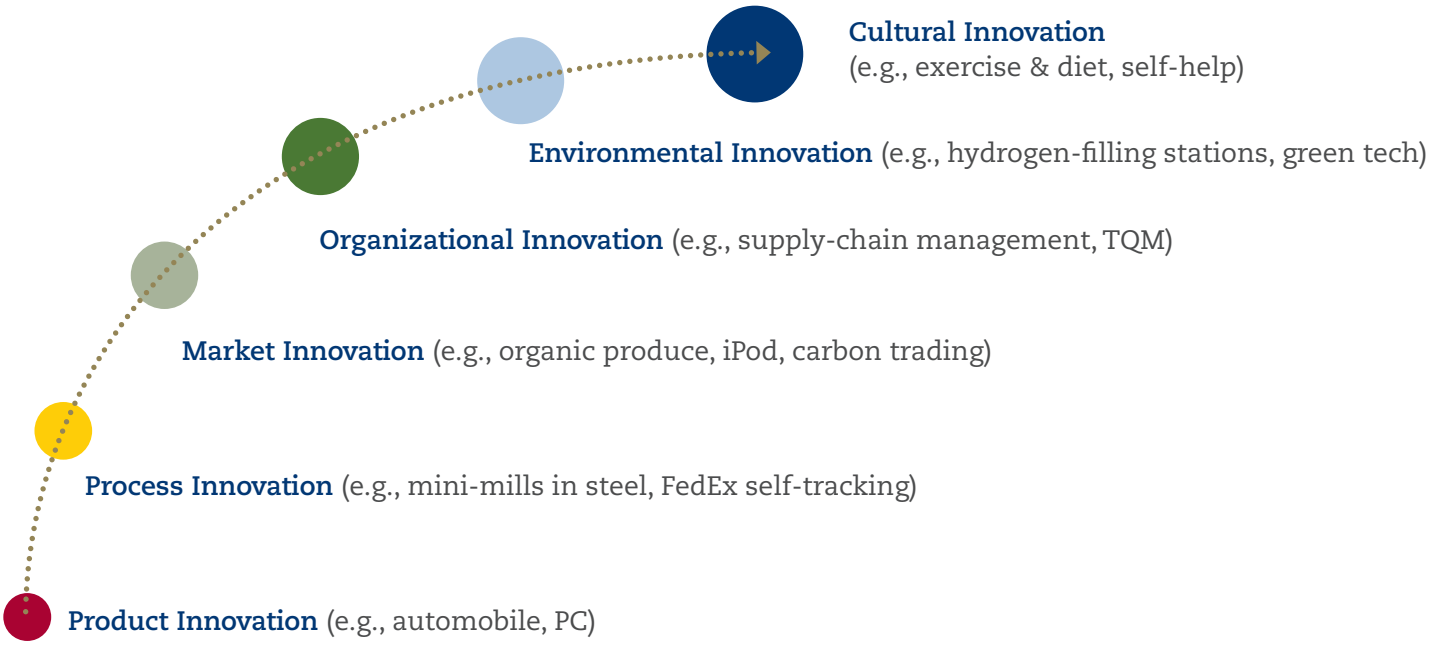
LESS UNCERTAINTY ABOUT HOW TO MANAGE UNCERTAINTY

Today's companies have better tools to deal with uncertainty than companies did in the 1960s. "We have a deeper understanding of how to handle the spectrum that runs from certainty to uncertainty to ambiguity to chaos, and we know better which tools to use at each stage," he said (as explained in his book, *Profiting from Uncertainty*). One such tool is scenario planning, originally developed by military planners, in which you envision differing futures to gauge how each might impact the company and industry. Another useful tool is real options analysis, which places an economic value on flexibility and future information, and thus is very suitable for highly uncertain projects. Managing uncertainty also involves improving an organization's scanning and monitoring ability (as discussed in his book with George Day, *Peripheral Vision*). A new approach Schoemaker is excited about is the idea of viewing mistakes as portals of discovery. This enables an organization to capitalize on the lessons from mistakes to achieve success (as discussed in his new book, *Brilliant Mistakes*).

NEW ORGANIZATIONAL FORMS

The 9-to-5, Monday-through-Friday, 50-weeks-a-year working world culture of the 1950s and 1960s has given way to many new forms of organizations including virtual organizations that exist on the Internet, internal and external networked partnerships, and spin-out

Full-Spectrum Approach to Innovation



companies such as Agilent Technologies, which began as part of Hewlett-Packard. Other recently developed forms Schoemaker described include ambidextrous organizations, which can focus on existing products while also keeping an eye on creating new products or markets. Other examples are front-to-back companies, which place the customer at the center of all of their activities. For example, ING Direct puts the customers smack in front via the Internet through direct connections to the company's less visible back-end capabilities. Finally, Schoemaker mentioned "sense-and-respond" companies such as Zara, a fashion retailer that turns around individual customer orders in two weeks. The accompanying sidebar lists some of the tools these and other innovative companies use.

REVERSE INNOVATION

Both globalization and outsourcing have led to what is called "reverse innovation." It is no longer a one-way outsourcing street moving from West to East without ever meeting the twain. Professor Schoemaker noted that "while it's true that the West still exports many high-end products and services to the developing nations and imports cheap labor, adaptations or improvements developed in the emerging markets are now flowing back to the West and have the potential to revolutionize the way we do business here. Japan did a great deal of reverse innovation in the 1970s and 1980s when they took Western ideas about quality and process control, improved them significantly in such sectors as cars, electronics, ship-building, etc., and then taught the West a thing or two about how you really build great cars or televisions. The same is happening in Brazil, China, and India in such fields as biofuels, IT, medicine, and beyond. New approaches to making artificial hips, for example, that fit the lower income levels in India, may find their way back to the U.S. or Europe to serve segments of the market ignored (just as we saw with micro-lending)."

THE TYRANNY OF THE BUDGET

Despite the new organizational forms and innovation tools available to today's managers, inflexible budgets and audit trails were mentioned as the two biggest hurdles by the audience. Most budget directors spend over half of their time estimating and overseeing budgets, rather

Tools & Methods for Innovation

Ethnography
listening to the customer
—but *really* listening

Lead User Innovation
tapping into pioneering
customers and then cocreating

Scenario Planning
mapping out the future
while respecting uncertainty

Peripheral Vision
changing before others do

Innovation Tournaments
leveraging the wisdom of crowds

Blue Ocean Strategy
creating demand in an
uncontested market space

Connect-and-Develop
picking up new ideas
from outside your sandbox

Real Options Modeling
putting a price on future
information and flexibility

than adjusting them in view of changed circumstances. This emphasis trickles down throughout departments, creating a chilling effect on any attempt at innovation. "Genuine innovation has a habit of happening at the wrong time, in the wrong place, led by the wrong people, in the wrong team, in the wrong part of the organization and may not even be recognized by senior leaders," Schoemaker observed.

According to one audience participant, a survey reported that only 53% of Fortune 1000 companies have an active innovation process. If more than half of your competitors are not paying attention to innovation, doing so can become an enormous advantage in the market and in hiring the best and the brightest. This participant also reminded the audience that in the early part of the 20th century, many companies appointed chief *electricity* officers, as that was the new technology on the horizon.

One way to counter this "tyranny of the budget," Schoemaker suggested, is to "change the way we think about mistakes. If you look at many breakthroughs, you'll see that they came out of a sequence of mistakes or failures." Not all mistakes are bad, he noted. Adopting this mindset opens the way for testing new processes and projects, even ones that may not initially look promising. Many successful innovations do not become so until they are nourished at an early stage through many setbacks, failures, and learnings.

In summary, while no one can predict the future and identify game-changing new products, services, or systems with certainty, there are useful frameworks and tools available for companies to foster innovation in practice. Innovation is not easy, and companies must periodically rethink their approach to risk, mistakes, and learning. If not, competitors will leap ahead due to having greater failure tolerance, and, as a result, faster learning and more novel strategies to compete in the market place.

Key Points

- Many innovative breakthroughs are the result of numerous mistakes.
- Many new innovative strategies and tools exist, along a wide spectrum.
- Flexible budgets that permit broader exploration can drive innovation.
- Innovation is a competitive advantage when the world is changing.
- Nurturing fledgling projects from an early stage is key in innovation.

Profile

PAUL J.H. SCHOEMAKER

Research Director, Mack Center for Technological Innovation; Adjunct Professor of Marketing, The Wharton School; and Chairman, Decision Strategies International

Dr. Schoemaker is an internationally renowned thought leader in the fields of decision making and strategy. He has written extensively on these subjects in theory as well as practice; the ISI citation index ranks him in the top 1% of scholars worldwide in business and economics. His latest book is *Brilliant Mistakes*. Dr. Schoemaker is research director of the Mack Center for Technological Innovation at Wharton, where he teaches strategy and decision making. He is also the founder and executive chairman of Decision Strategies International (www.decisionstrat.com), which specializes in strategy consulting, leadership development, and associated product development.

Innovation: Looking Beyond the Innovator

Sidney G. Winter

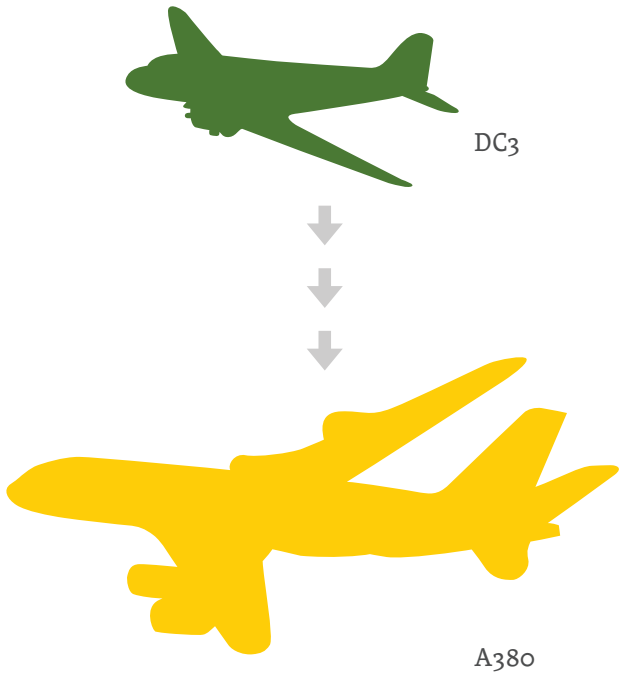
Thinking of innovation as merely the "aha!" moment of a single inventor ignores the complex ecosystem needed to foster and grow real, tangible innovations on a regular basis. Dr. Sidney Winter, Deloitte and Touche Professor Emeritus of Management at the Wharton School, delivered "Innovation: Looking Beyond the Innovator" at the June 3, 2011, Mack Center conference, The Changing Face of Innovation. Pulling back from the single researcher in the lab to the organizational and societal components of innovation provides a higher level view of the cumulative and repetitive nature of innovation. Dr. Winter identified the differences between invention and innovation and discussed the "dynamic capabilities" and learned competence that corporations need to produce innovative products and services on a continuing basis. Winter identified the drivers of innovation at societal levels above that of the creative individual, including the structures and cultures that companies need to create to foster, not dampen, innovation.

Innovation does not exist in isolation, or only in sudden, inspiration-filled "aha!" moments. Such a mindset leads to what Dr. Winter termed the "cult of the lightbulb" and ignores the complexity of the contexts from which innovations emerge. Rather, innovation evolves out of a cumulative and social process and sometimes involves simply following the same process again and again—riding the wave of the general advance of knowledge. The science of electricity, for instance, was started by pioneers like Penn's own Benjamin Franklin—recall that famous experiment with the kite and the key. According to science historian Thomas Kuhn, Franklin's discovery of the electrical properties of attraction, repulsion, and conduction provided subsequent generations of scientists and inventors with a common paradigm for their research. The science of electricity advanced over the decades in a cumulative process and continues to drive innovation today.

Innovations follow what Winter called technological trajectories and paradigms. As noted by Thomas Kuhn in the case of scientific paradigms, Winter said, "There are characteristic modes of problem solving in a technology and it is the repeated application of these same heuristics to the underlying technology that shapes the trajectory." Two extreme examples are the airplane and semiconductor devices, starting from the transistor. For the transistor, the trajectory was one of miniaturization; for the aircraft, it was one of scale augmentation, of increasing size. The repeated application of these concepts (miniaturization/enlargement) shaped the products seen today in these

fields. Today, the world's largest commercial aircraft, the A380, is easily recognized as a scaled-up version of its evolutionary ancestor, the DC3, a craft first developed in the 1940s. The patterns used in the DC3 were continuously mimicked, stage by stage, culminating (for now) in the A380. Similarly with transistors, engineers just kept making them smaller.

But does this sort of regular, cumulative progress deserve the name "innovation"? Consider the remark of Ralph Gomory, who as IBM's vice president of R&D in 1983 suggested that there was no innovation in semiconductors—only engineers doing "the same thing over and over again." If that kind of repetition is just boring, not innovation, it is the kind of boring activity that made the world we live in.



Innovation is more than a single "lightbulb" moment and requires repeated applications of previous knowledge and know-how. One extreme example is the scaling up of the DC3 over many decades to create today's A380.

For a company, the trick is to be the only one in the market space who *CAN* do a particular thing well, over and over again, Winter said. By doing so you are making proactive use of your company's dynamic capabilities: You are *creating* a change rather than *responding* to a change. As Gomory certainly understood, the change created by the continuous miniaturization of semiconductors was not unimportant, though it did not involve any big new "aha" moments. Moore's law was enacted via many small "aha" moments—bursts of creativity shaped by the high-level guidance of the miniaturization trajectory, repeated over and over again.

INVITING INNOVATION IN

Dynamic capability resides in the skilled professionals of an organization and in their powerful linkages to outside knowledge sources and markets—and also, Winter emphasized, in "the human resources practices that allow an organization to attract and retain talented individuals." Some may take the view that involving any kind of bureaucracy or controls, such as a human resources department, is a barrier that "routinizes" and thus taints the innovative process, dimming the proverbial lightbulb. Economist Joseph Schumpeter, Winter noted, even claimed that such routinization of innovation would lead to the end of capitalism—because socialists can run a bureaucracy just as well, maybe better. "He was wrong! Entrepreneurship is still a huge force in our economy, but so is routinized innovation. It depends on the type of routinization that is used—there can be good or bad processes; good processes facilitate innovation by making bureaucracy 'enabling' rather than 'coercive'."

THE INNOVATOR'S TOOLKIT AND WORKSPACE

Scientific knowledge develops both in a linear fashion and in sporadic paradigm shifts, and likewise innovation is sometimes influenced by sudden, dramatic shifts in knowledge. Most of the time, however, innovation is shaped by the current set of technological tools (i.e.,

current technological and scientific knowledge) and the recognized market needs. These are the parameters of potential innovation, in the great majority of cases. Inventors and innovators are responding to a need, not creating something in a vacuum. Mostly innovation is about systematically using the new means that have become available and responding to new ends, not just benefitting from occasional flashes of creative insight. As Thomas Edison is credited with saying, invention is "1% inspiration and 99% perspiration." The potential for innovation arises from many dimensions, including the organizational processes and the unique experience of the individual, how that individual interacts and communicates with his or her peers, the available technology and resources, the individual attributes and organizational structures that favor perseverance, control, and discipline, and (granted) the ability to get free from all of that occasionally and deliberately pursue a "lightbulb" event by "thinking outside the box." In general the advance of scientific knowledge strongly supports innovation—but not always in a strictly linear fashion, and with lags that are long and uncertain.

Winter outlined the social and contextual aspects of innovation and the dynamic capabilities needed on the organizational level that are essential for achieving successful innovation. "If you look at new product development, in the complex systems industries, like auto and aircraft, you'll see that, essentially, it is successive rounds of producing incrementally better products."

Edison himself, Winter said, claimed that none of his inventions "came by accident." No matter how many attempts it took, Edison would persevere until his invention filled the unmet need he had identified as his goal. Today, successful organizations are the ones that create and maintain the space and the culture for such trial and error to happen, Winter noted. "The initial 'aha' moment of the semiconductor trajectory was the invention of the transistor, and after that, the recognition of the potential for miniaturization," he said. "So companies kept making transistors smaller and smaller and creating dynamic change by doing so."

FROM CONCEPT TO COMMERCIALIZATION

History shows that oftentimes there are several persons who achieve major inventions almost simultaneously. The telephone is one example. In 1876, both Alexander Graham Bell and Elisha Grey arrived at the U.S. patent office on the same day with plans for essentially the same invention—the telephone Bell was applying for a patent for his new invention while Grey was there to file a "caveat," which under the law of the day would allow him to claim a patent on a similar device, previously abandoned, within six months. While this example is perhaps the most well known, history teems with abundant evidence showing the simultaneous, independent discovery of similar advances. The point is that Bell and Grey were not seeking "lightbulb" insights from on high—there was new technology available and they both came up with ways to use it. The example is not atypical; many inventors around the world have independently made the same discoveries, illustrating the concept that, Winter said, "inventions are being fundamentally generated by the context, by the changing sets of innovation tools and the demands." As with individual inventors, for organizations, the key to profitability becomes one of timing—who gets the patent and who is the first to commercialize a product.

Invention itself is cheap; it's the innovation that is difficult, Winter said. As Schumpeter noted, it is the "introduction of a novel product, process or organization … into actual practice" that is much more difficult and expensive. Just because you can invent and produce

something novel does not guarantee its success. The question is whether you can find someone who is willing to pay more for it than what it cost you to produce it, Winter said, quoting Larry Huston of 4iNNO. Again, context is key. Does your invention fit into an existing market condition? What similar products, if any, are your competitors offering? Finally, do you have the scale to make your invention profitable?

DRIVERS OF INNOVATION

In addition to a company's dynamic capability (exploiting the advantages of practice in the creation of specific kinds of novelty), Winter identified other drivers of innovation: scientific and technological progress; access to academic or think-tank institutions, government, or other sources of sufficient funding; and opportunities for recombination—reuse of designs, component improvement within systems, specific applications of "general purpose technologies" (i.e., the Internet or computers). Also important to creating innovation is what Winter termed "situated learning" capacity, the ability to exploit the local signals about what is possible and/or desired in the market. Hand-in-hand with situated learning is the ability to *recognize* the novelty of what you are looking at and being able to find the problem that it might solve (serendipity).

In summary, innovation depends ultimately on advances in understanding of fundamental science, access to the newest technological tools, and insight into the forms that long-standing human needs now take. In an organization, innovation thrives in a culture where trial and error is encouraged and where the scale of operations supports the sustained pursuit of ambitious, risky objectives. Such an organization has a solid place to stand and will generate value from the vastly turbulent information streams going by—the streams from basic science, from new technology, and from the evolving patterns of demand.

Key Points

- Innovation is more than a single "lightbulb" moment and requires repeated applications of previous knowledge and know-how.
- The "routines" of perseverance, control, and discipline are the roots of "dynamic capabilities" that allow a company to *practice* innovation rather than merely *responding* to innovation.
- Innovation is a social and cumulative process that reacts to current needs.
- Innovations often occur simultaneously by different inventors.
- Practice, practice, practice. Even the creation of novelty becomes easier with practice.

Profile

SIDNEY G. WINTER
Deloitte and Touche Professor Emeritus of Management, The Wharton School

Sidney Winter's career included appointments in four universities, in departments of economics, public policy, and management. He also spent eight years in policy research or government roles. He has pursued a theory of firm behavior that is more realistic than the standard neoclassical model and provides better foundations for studies of innovation, organization, and managerial practice. With Richard Nelson, he developed the leading modern statement of an evolutionary view of economics. As the author of "Understanding Dynamic Capabilities" (2003), he was a corecipient of the 2009 Best Paper Prize of the Strategic Management Society.

Why Design Thinking Is the Next Competitive Advantage

Roger Martin

Up to 80% of businesspeople aren't happy with the level of innovation at their companies. Why? Current management practices, which are largely dependent on proving the success of a project before funding it, contribute to that dissatisfaction. Learning to use design thinking—finding ways to create the most elegant, efficient, and effective way to do something the way that is most matched with the user's needs—requires companies to use less scientific thinking and include more intuitive thinking in their business processes. "These two forms of thinking compete and create difficulty for innovation," said Roger Martin, Dean of the Rotman School of Management, University of Toronto, during his presentation, "Why Design Thinking Is the Next Competitive Advantage," at the June 3, 2011, Mack Center conference, The Changing Face of Innovation. According to Martin, changing your style of thinking requires changing your style of managing both the intuitive and scientific thinkers in your company.

By depending too much on deductive and inductive reasoning, companies fail to nurture their creativity or intuitive reasoning skills, which are necessary for new, breakthrough ideas. "Every big company has to ask itself—how did we get here? And how are we going to continue to stay at the top?" Martin said. Only by balancing scientific thinking with intuition can companies continue to innovate and grow.

RELIABILITY VERSUS VALIDITY

As a rule, businesses rely on the scientific method, in which things must be quantified, generalizable, and reproducible. Business schools emphasize scientific thinking, the ability to prove something before it happens. By doing so, you create reliably consistent and replicable outcomes. Inductive and deductive logic are applied to prove something true or false before taking any action or doing any experimentation. But without exploring or experimenting, you are trapped into doing the same thing over and over again, which is the antithesis of innovation. As an example, Martin used the Stanford-Binet IQ test, which measures intelligence by designing lots of little logical puzzles to solve over and over again, but which leaves no room for judgment, "could have," or "maybe." It is learning to be comfortable with these "maybes" that makes a company truly innovative.

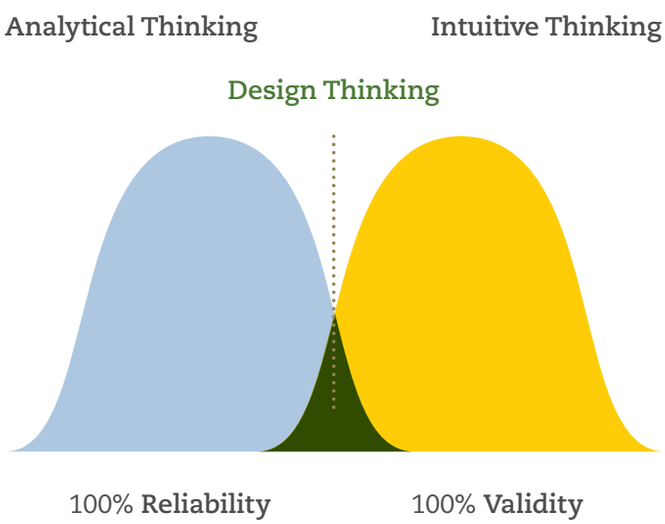
"What we want is some validity as well as the reliability of the scientific method, and, in fact, people who use validity as their goal are the ones who use intuitive thinking, which is knowing without reasoning," Martin said.

THE LOGIC OF WHAT MIGHT BE

The two most dangerous words for innovation are "prove it." "They crush innovation and if you think of the systems we use in daily business, many are based on 'prove it.'" If entrepreneurs had to prove that their ideas would be successful, they'd be dead in the water. Martin cited the American philosopher Charles Sanders Peirce who introduced the idea of "abductive logic." This kind of logic fills in the gaps when people can't solve a problem with either inductive or deductive logic. "Human beings don't just sit there and say, 'I'm confused.' They make an inference to the best explanation, they answer the question, 'What could be the reason I am seeing this phenomenon.' I call it the logic of what might be, and this form of thinking has been more and more illegitimatized because it's the opposite of scientific thinking."

Design thinking, on the other hand, is the form of thinking that embraces inductive and deductive logic, but unless you embrace abductive logic, the logic of what might be, Martin said, you will lurch from success to failure.

Bridging a Fundamental Predilection Gap



Only by balancing scientific, or analytical thinking, with intuition can companies innovate and grow.

HOLLYWOOD'S GOLDEN GUT

Miramax Films's Harvey Weinstein, who produced such hits as *Pulp Fiction*, *The English Patient*, and *The Crying Game*, which other Hollywood studios passed up, is an example of the quintessential intuitive thinker. After Disney took over Miramax and Weinstein left, Miramax began to use more traditional methods for selecting films. The result? Miramax doesn't make any more hits, and eventually closes. Meanwhile, Weinstein goes on to produce more hits including *The King's Speech*. "He doesn't tell anybody how he does it," Martin said. "He just says he has the golden gut of Hollywood." Nevertheless, organizations cannot be all analytical or all intuitive. "If you run an organization based entirely on reliability you are never going to produce anything new; if you run an organization that's all based on validity orientation and intuitive thinking, you can get very big but you will really just be lurching from one ditch to another," Martin said.

DISCUSSIONS VERSUS PRESENTATIONS

As a consultant to Procter & Gamble (P&G)'s then newly appointed CEO, A.G. Lafley, Martin oversaw the company's subtle but very powerful shift in how it conducted annual strategy sessions with its category presidents. "I would argue that this one change was the most important change that spurred innovation," Martin said. What was it? Top management banned slide presentations. Historically, each P&G business unit or category president would come to the strategy review each year with a big thick slide deck, with prerehearsed, "bullet-proofed" material, including several slides of preanswered questions. The goal was to get in and get out.

Instead, each category president was now told to submit, two weeks prior to the annual strategy review meeting, whatever materials they wished. Executives read the

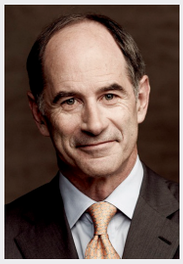
materials and replied with three to five questions that they wanted to discuss at the meeting. Category presidents were allowed to bring with them three, new 8½ inch x 11 inch pages of material—not including any material that they had originally sent. Executives ruthlessly enforced the "no slides" rule, Martin emphasized.

What's interesting about this change is how overdue it was, yet no one had bothered to question the status quo. As a consultant, Martin met with both category presidents and top management to get their views on the existing strategy review process. "Both sides basically told me they felt the process was pretty useless but they felt the other side enjoyed it." Still, it wasn't easy to get real, deep discussions started. "It took about two years before the category presidents were comfortable with the new process. The executives had to prove beyond a shadow of a doubt that the new process was about creating possibilities, that it wasn't a way to find fault with the presidents," Martin said. Building trust was essential in creating back-and-forth dialogues about new ideas. "It took budgeting that $1 million on an idea brought up at a strategy session, and the following year's discussion" until the employees became convinced of the validity and value of the new process.

The new, dialogue-based strategy review process changed the way senior people in the organization talked about the future and got them talking about things you couldn't prove. "This one change produced more dreaming about what might be and more use of abductive logic, and I don't think P&G can go back to their old way of doing strategy review," Martin said.

Key Points

- Management can discourage innovation by overdependence on the scientific method, or "prove it" processes.
- Learning to be comfortable with some level of "maybe" is part of being innovative.
- Companies need to balance intuitive thinking with scientific thinking to foster innovation.
- Create real, meaningful dialogues rather than preplanned presentations.
- Trust among executives, managers, and employees must be in place before innovation can occur.



Profile

ROGER MARTIN

Dean of the Rotman School of Management, University of Toronto

Roger Martin has been dean of the Rotman School of Management since 1998. Previously, he spent 13 years as a director of Monitor Company, a global strategy consulting firm based in Cambridge, Massachusetts. He writes extensively for newspapers and magazines including *Financial Times*, *BusinessWeek*, *The Washington Post*, *Fast Company*, and *The Globe & Mail*. He has written 13 articles and authors a regular blog for *Harvard Business Review*. In 2010, he was named by *BusinessWeek* as one of the 27 most influential designers in the world. In 2011, he was named by Thinkers50 as the 6th most influential management thinker in the world. He serves on the boards of Thomson Reuters Corporation, Research in Motion, and the Skoll Foundation.

The Innovator's DNA

Jeff Dyer

It takes more than thinking differently to run a successful innovative company. It takes execution and the practice of five basic discovery skills—associating, observing, experimenting, questioning, and networking—according to Jeff Dyer, who coauthored "The Innovator's DNA" along with Hal Gregersen and Clayton M. Christensen. This six-year study reviewed the practices of more than 3,500 business leaders to try to pinpoint "the moment they came up with their innovative business ideas and to understand everything we could about what contributed to the genesis of those ideas," Dyer told the audience at the June 3, 2011, Mack Center conference, The Changing Face of Innovation. Turning these disruptive ideas into profitable goods or services can give your company an "innovation premium" and positively impact the bottom line.

Creativity is the number one trait needed by business leaders in today's climate of increasing complexity and uncertainty. Although most believe that creativity is genetically bestowed, research by Dyer and his colleagues shows the opposite: Creativity is "much more rooted in our behaviors," Dyer told the audience. Whether you do or do not *inherently* have creative traits, he emphasized, practicing the five identified discovery skills can give you the creative problem-solving and innovative edge needed to succeed in today's challenging business environment.

WHAT DOES AN INNOVATIVE COMPANY LOOK LIKE?

Dyer and his associates rejected the usual published annual reports listing the top ten innovative companies, what they called a "popularity contest." Instead, they designed a method for identifying companies that have not just been innovative in the past, but which are likely to be innovative in the future as well. Dubbed the "innovation premium," Dyer defined it as the difference in the share price investors will pay over and above the current net present value. "For example, assume that the current income stream from Apple's existing business results in a stock price of $100. So, to arrive at the innovation premium, how much more are investors willing to pay over that $100? In the last five years, investors have been willing to pay $152 per share for a company producing only $100 per share That translates into a 52% growth and innovation premium."

But why will investors pay more, essentially, than a company's present business says it is worth? With Apple, Dyer said, it was because they believe in the ability of the company to create new and disruptive technologies. "We didn't know the iCloud was coming, but we thought something new was coming."

The top five innovative companies Dyer and his coauthors identified were, in order: salesforce.com, Intuitive Surgical (makers of the da Vinci surgical robots), Amazon, Celgene, and Apple. What these companies share is creative leadership, and, in the majority of cases, the founder of the company was still in a leadership position. "Leadership does make a difference." But take the case of a company founded more than 100 years ago, such as Procter & Gamble (P&G), where it's not possible for the founder to still be in charge. Its current CEO, A.G. Lafley, Dyer said, "exhibits a lot of the behaviors of these innovative founders: he is a great questioner and observer." Pre-Lafley, P&G's innovation premium was 23%; under his leadership it jumped to 35%. A similar jump in Apple's innovation premium whenever Steve Jobs held a leadership position is another example of how leadership affects a company's profitability.

NOT JUST DNA

One of the most striking findings from the study is that, in general, creative thinking is a balance of nature and nurture—innovative thinkers are not just "born." Dyer and his coauthors studied identical twins who had been raised separately to learn about the genetics of creativity. In cases where twins raised separately were given IQ and creativity tests in their young 20s, on average 80% of the IQ tests are related to genetics, but only 33% of the creativity test scores were related to genetics. "So in fact creativity is influenced a great deal by our environment, our role models, our experiences, and our cultures," Dyer said. For instance, he has noticed after living in Asia that the corporate cultures there strongly discourage ever questioning your boss, which effectively dampens creativity in the workplace.

THE FIVE TRAITS

Associating

"We think of creativity as a cognitive skill, that it happens in the brain," Dyer said. "Often it is referred to as right brain thinking; in our book we use the term 'associational thinking.'" Basically, associational thinking involves taking something you know from one context and applying it in a different way in a new context. "Steve Jobs said creativity was connecting things," Dyer said. He showed the audience pictures of a hard drive, a symbol for the Internet, a music symbol, a computer, and a lock. Steve Jobs looked at these individual components and came up with the iPod. "When you ask creative people how they did something, they feel a bit guilty because they just saw something and they don't feel they've really done anything." It was his associative ability to connect experiences and synthesize them that led Jobs to the iPod.

Observing and Questioning

Why are some people better at associating than others? People who are keen observers tend to question the status quo. If you are not consistently questioning the status quo, how can you change things for the better? Business innovators "spend a lot of time observing in different environments and are much more likely to travel, live in different countries, work in different companies," Dyer said. Doing so helps them notice the anomalies, or the surprises that can lead to innovative ideas. Scott Cook, who developed Intuit, claims it was observing his wife's frustration over handling finances that led him to design the company's iconic software. But it was connecting that level of frustration with doing finances *AND* his "sneak peek" at the Apple that literally drove him to stop what he was doing and write down his idea on a paper napkin at a fast food restaurant. "Finally, a computer that the average person could use, and you could make checks appear on the screen and manipulate them, with all of the back-end calculations easily done." He is not an accountant, but it was his connection of these two observations that led to the creation of a top-selling software.

Not all questions are created equal. One of the companies studied in *The Innovator's DNA* was Google, which treats questions as a key component of creativity. "One of Google's principles of creativity is constraint," Dyer said.

Frame a question with strict boundaries. For instance, ask yourself, "What if it became illegal to do business with all of your existing customers?" This kind of imposed constraint forces a company to think about its capabilities, competencies, and how they could be repurposed and redeployed. Jobs's questioning the excessive noise of the fans computers needed to keep them from overheating led to the development of a new cooling system, which was debuted in the Apple 2. "This is why asking questions is so important. Jobs didn't create the new cooling system, he just questioned why computers couldn't be quieter."

A member of the audience raised the issue of the "social risk" of constant questioning, especially in a department like accounting where following processes is seen as paramount. If an organization does not have a culture that encourages questioning and the other discovery skills, as well as top-notch employees with the right skill sets, constant questioning will not be acceptable, Dyer admitted. He gave the example of an executive who personally began writing down questions to himself every day about his business, industry, and competitors. He noticed after a few months of doing this activity, that people remarked on his creative thinking skills.

Questioning by itself was not enough, Dyer and his coauthors concluded, "you can't just sit in your room and be an armchair entrepreneur." It was the combination of questioning, observing, and networking that made things happen.

Networking

There is more to networking than LinkedIn and business events. Disruptive innovators seek out perspectives from people from different backgrounds. For instance, David Neeleman, founder of JetBlue, came up with the idea for e-tickets after talking to an employee who share his frustration of having to transport paper tickets and

The Five Discovery Skills Used By Innovative Business Leaders

Observing

See what others don't do in a situation; look for the anomalies.

Questioning

If you don't question the status quo, you can't start a revolution.

Networking

Actively seek diverse ideas to gain a new perspective.

Experimenting

Explore to find new business ideas or insights. Experimenters visit new places and seek new information to pilot ideas and test hypotheses.

Associating

Make unexpected connections between diverse experiences, products, or technologies.

guarding them as if they were cash. Neeleman went outside of his usual business network and listened to an employee directly involved in the company's day-to-day operations.

If you are what Dyer terms a "discovery-driven" executive, you seek out "interesting people, people who are different from you, to gain new ideas." Their strengths are questioning, observing, and experimenting. The "delivery-driven" executive, on the other hand, works efficiently to deliver the next thing that *should* be done *given* the existing strategy/business model and problems associated with executing it. Delivery-driven executives shine at organizing work, quantitative analysis, and conscientiously executing on logical, detailed, data-driven plans of action. Of course, any new idea needs flawless execution to succeed; but as a rule, delivery-driven executives are less likely to seek out divergent, new experiences and are less likely to make associations across knowledge domains due to a smaller stock of unique ideas from different knowledge domains, Dyer said.

Experimenting

Seeking out new experiences that may not have a direct link to your day-to-day functions can spark innovations. Steve Jobs's college calligraphy class gave him the idea, ten years later, to include multiple fonts in a personal computer, which led to the revolution in desktop publishing. Richard Branson's famous quote that he will try anything once has led to the creation of more than 300 Virgin companies. Amazon is "always experimenting"; it beta tests a new idea with 20% of its customers to see the reaction. Amazon is constantly looking for ways to reduce the cost of an experiment so it can conduct more experiments.

In summary, creativity is the number one trait companies look for in a leader, and successful business innovators share several basic discovery skills that anyone can use. Practicing these skills is a powerful way to increase your own creative thinking.

Key Points

- Act differently, don't just think differently.
- Creativity involves five basic skill sets that anyone can use.
- Creativity is not just a genetic trait.
- Practice behaviors that invite diverse knowledge to trigger new associations.

Profile

JEFF DYER

Horace Beesley Professor of Strategy, Marriott School, Brigham Young University

Jeff Dyer is the Horace Beesley Professor of Strategy at the Marriott School, Brigham Young University, and adjunct professor at the University of Pennsylvania's Wharton School. He is the only strategy scholar to have published five times in both *Strategic Management Journal* and *Harvard Business Review*. Essential Science Indicators recognized him as the fourth most cited management scholar overall (1996-2006) in the combined fields of management, finance, marketing, operations, and economics. His Oxford book, *Collaborative Advantage*, was awarded the Shingo Prize Research Award, and his article "The Innovator's DNA" was the McKinsey Award runner-up for the best article in *Harvard Business Review* in 2009. His book *The Innovator's DNA*, published by Harvard Business Review Press in 2011, is an Amazon and Inc. business bestseller and has already been translated into ten languages.

Networks and Innovation

Rob Cross

What if you could see innovation as it happened at your company? Imagine visualizing the communication networks among employees within and between departments. Such informal communication networks are a vital lifeline for innovation. Rob Cross, Associate Professor of Commerce at the University of Virginia and Director of The Network Roundtable, demonstrated a technique for visualizing these networks and their impact on innovation at the June 3, 2011, Mack Center conference, The Changing Face of Innovation. How healthy are these networks within your firm? Is information vital to new ideas or products locked away in silos, stifling innovation? Are the people in the networks energized, and how safe do they feel about bringing up new ideas? Not only can smooth information flows spur innovation, but mapping communication networks can yield insights on how to correct poorly functioning networks and identify who are the most influential people. Paying attention to the roles employees play within networks can guide executives' decisions to help improve innovation across the enterprise.

NETWORKS AND COLLABORATION

Mapping how information moves throughout your company reveals who is collaborating, with whom, and on which projects. "What would you do differently if you could see the collaborations that were happening in your organization—whether it's an R&D function, or a new product development team?" Cross asked. Having this information is like taking an X-ray or MRI of the innovation process, which can give you insights into how and where collaborations are either spurring innovation or generating friction.

Cross explained how the 15-minute, web-based survey he uses can gather information that allows him to map interactions between employees; other, less high-tech versions of mapping these pathways can also yield valuable data. Cross calls his process an organizational network analysis (ONA). "The web-based survey takes about 15 minutes and gives you some incredibly rich analytics," he explained. "I am always interested in two components: who is collaborating from an information perspective, and where are the overload points?"

Network overload is "too much focus up in the hierarchy that drives excessively slow decision cycles." The key to unblocking this slow decision cycle is building trust among network members. Frequently the ONA results show that many of the senior people have become isolated and are too far removed from day-to-day operations. As executives are moved higher up in an organization, their work often

becomes more administrative, which makes them less accessible, thus slowing down critical decision times. "In pharmaceutical companies in particular, decision delays can be extremely costly," Cross said.

NETWORK ROLES

The ONA survey asks employees to identify their most trusted sources for sharing ideas with—the people they feel most comfortable with when discussing projects or ideas. An ONA can also show you how many people interact with a certain person, who only asks for information, or who only responds to queries. This information can help you identify which role employees play in a network: the central players, the fringe participants, and the brokers.

Central Players

These are the 3% to 5% of people in any network who account for up to 35% of the value-added contributions. They're not always the most obvious people. Cross observed that most business leaders are only half right most of the time when asked to identify central players. "Often they are not aware of people who have gotten very prominent and who are supporting others in different ways. It's a really important way for me to see who the core opinion leaders are; these are the people who can help drive innovation or accept a cultural change and then push it through."

Fringe Participants

You could be missing valuable new ideas unless these people get included.

Brokers

These are the people who can turn ideas into actions because of their cross-functional ties within the company.

"Almost everyone has been on a team where it's not the full team of equally contributing members who are pushing an idea ahead. It's usually a subset that forms around the idea, which really drives the work. The important members are those with bridging ties, or the brokers. These team members have contextual knowledge for the products they want to build, know how to go out and get decision approvals and resources, and have external ties, such as how to work in China." In fact, this is the biggest predictor of success of a team—how well ingrained are they with external connections? It shows where value is being created, Cross said. "If we can make sure the brokers get on those teams, things happen more rapidly. They have informed perspectives on what is going to work in different pockets of the organization, and they are not wed strictly to their own way of thinking."

CORE INNOVATION CHALLENGE

Using the ONA to compare a company's organization chart with an informal network can reveal which employees are overworked, which are ignored or isolated, and it can also identify information silos. Cross's consulting experience with large multinational companies has revealed that it is easy for people to become too dependent on past experiences. "I've been to a lot of companies where I'm told, 'We hired all these new people with key technological capabilities to get us going in a new trajectory, but we're not seeing any progress.'" The problem lies in the lack of informal or peer networks. By looking at the network patterns generated from data gathered in an ONA survey, Cross identified how newcomers can be isolated and not given the opportunity to share their insights. "This is the core innovation challenge I see at a lot of companies," he said. "What ends up happening is that the old timers at the company dominate, so the newcomers become overly reliant on all of the people who were good for yesterday's capabilities." Often, these new people get so frustrated they leave the company. Even executives who rise up the ranks within a firm will continue to hold on to the ties they made in the departments where they either started or were most recently located. "This is one of the traps I see

in my work. Almost all of us have a tendency to confuse trust with friendship. You also need to ask if the people in your networks have the expertise you need, or are they in your network just because you are familiar with them." The most valuable connection in any network is reaching out to someone with a different perspective, knowledge, or skill set.

RETOOL CORPORATE OFFSITES

Offsite meetings are a familiar management tool used to initiate informal communication. The problem is that people tend to interact only with people they already know. This can actually serve to entrench existing, often faulty, networks rather than expand or enrich them. Cross has added a twist to the standard offsite team-building meeting. At one such meeting, each employee wore an RFID tag programmed with his or her expertise. "We also programmed in their networks, and the participants were given points for connecting with someone outside of their network. Employees' badges would light up if they approached a person whose capabilities would be a good fit for helping the company reach its current innovation target on a certain project." The resulting conversations turned out to be, on the whole, quite vibrant. Most importantly, people from different parts of the company were talking to one another and learning what each does and, whether they knew it or not at the time, were coming up with ways to collaborate and innovate in a fun and relaxed setting.

"This exercise gave the head of R&D a baseline to see the organic possibilities for innovation as an alternative to going outside and doing an acquisition to create growth." The company did go on to launch a highly profitable new product extension as a result of that meeting.

THE FEAR FACTOR AND BUILDING ENTHUSIASM

Another integral part of mapping informal networks involves learning about the levels of trust and energy

Energy-Building Behaviors for Strong Networks

1. Strike an effective balance between tapping people in your network to get work done and connecting with these people on a personal level unrelated to our work.
2. Maintain a good balance between what you ask for and what you contribute to those in your network.
3. Consistently do what you say you are going to do and follow through on commitments you make to people in your network.
4. Be committed (and show this commitment) to principles and goals that are larger than your own self-interest.
5. In meetings and in one-on-one conversations, engage others in realistic possibilities that capture their imaginations and hearts.
6. Be fully attentive in meetings and one-on-one conversations and show your interest in others and their ideas.
7. Create room for others to be a meaningful part of conversations and make sure they see how their efforts will contribute to an evolving plan.
8. When you disagree with someone's plan or a course of action, do so in a way that focuses attention on the issue at hand and not the individual.
9. Maintain an effective balance between pushing toward a goal and welcoming new ideas that improve the project or process for reaching a goal.

within them. "If you map who enthuses whom, that's stunning," Cross said. "It outperforms anything in terms of predicting the likelihood of leadership success." Fear, i.e., holding back ideas in the presence of certain people, can also be identified through an ONA. Knowing the characteristics of these networks helps companies identify the talent they have in-house; but unless the network is functioning smoothly, they may not be using all of the talent that could be used for innovation.

STRENGTHENING NETWORKS

Once you have identified the informal communication networks, what are the next steps? The most important goals are to break down information silos and then to learn the best way to manage the center of the network more efficiently. "From an innovation standpoint, see where you are overloaded with old expertise or places where decision rights aren't well allocated," Cross said. See if you are getting any input from people on the fringe, where some truly innovative ideas could be lurking. Look at each juncture in a network and ask yourself how you could be better at driving innovation. During his research, Cross has identified nine energy-building behaviors for network members (see sidebar). Another finding in Cross's research has been that distance between groups has little bearing on the level of communication or collaboration. "I have been to companies that have built the 'lab of the future' or got rid of their cubicles for the curved wall design. But unless you are doing other things right, like building trust, or sharing the common awareness of expertise, people are still going to isolate in their curved-wall spaces just as much as they did in their cubicles." A network analysis can uncover who are the real experts on specific topics, the people whom others turn to for information.

Key Points

- Mapping the informal information flow at your company can yield valuable information on the level of collaboration and innovation.
- Identify the roles people play within networks and leverage these skill sets as needed.
- Learn where your networks are overloaded and address decision-delaying behavior.
- Build trust in networks.
- Use network analysis to spot information silos.

Profile

ROB CROSS

Associate Professor of Commerce, University of Virginia; Director, The Network Roundtable,

Rob Cross is Professor of Management at the University of Virginia and Research Director of The Network Roundtable, a consortium of 75 organizations sponsoring research on network applications to critical management issues. He studies how relationships and informal networks in organizations can be analyzed and improved to promote competitive advantage, innovation, customer retention and profitability, leadership effectiveness, talent management, and quality of work life. Rob has worked with more than 200 strategically important networks at well-known organizations in consulting, pharmaceuticals, software, electronics and computer manufacturers, consumer products, financial services, petroleum, heavy equipment manufacturing, chemicals, and government. His writings include award-winning books and articles.

Collaborative Innovation and the Pull Economy

John Seely Brown

Today's new digital infrastructure has changed the rules for business and the process of innovation. At the heart of this new infrastructure is cloud computing, which has enabled almost anything to be done faster and cheaper. Conquering the cloud means learning new skills rapidly and routinely. Business leaders are constantly being challenged to rethink everything they have learned. The old business model of scalable efficiency and reliable predictability is falling away, but "…the digital technology curves are basically unbounded in terms of exponential growth." We are now at an "amazingly important and challenging moment where scalable efficiency needs to give way to scalable learning."

This was the challenge issued by John Seely Brown in his keynote address at the Mack Center's June 3, 2011, conference, The Changing Face of Innovation. Dr. Brown described some of the remarkable opportunities offered by cloud computing and other enabling technologies in the still-evolving digital infrastructure. How can we achieve this exponential growth? The willingness to learn in the new networks that are growing within the more traditional types of industry, building trust within these networks, and courageously facing these dramatic changes will be essential.

CREATING NEW VALUE MODELS

Seely Brown described the new learning networks as knowledge flows—two-way streams that create and impart knowledge. This knowledge is more often tacit than explicit, which necessitates creation of a new model for value creation, replacing the standard assets of goods and services. The companies that take advantage of these knowledge streams by building their dynamic capabilities will be the winners in the digital economy. "If you thought innovation was something that used to be important, now it's ten times more important," he said.

With the constant disruption caused by advances in technology, how do you create value within the digital infrastructure? It's simple but not easy. The new value is not in the usual assets of tangible goods or products, but in the art of collaboration itself. "We are moving from stocks of assets, such as specific skill sets, to collaboration that creates new knowledge," Seely Brown said. The key is that you are not just sharing old knowledge, but creating and sharing new knowledge in these back-and-forth knowledge flows. You seek capability leverage rather than financial leverage. "Companies today cannot

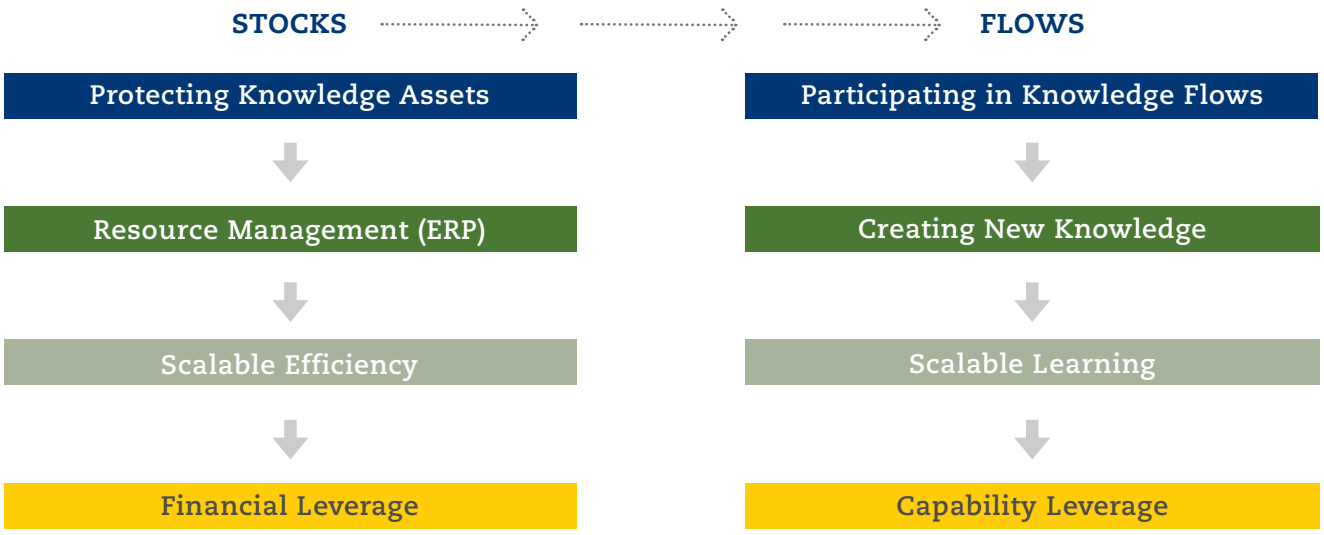
leverage or learn this fast enough using the old models of financial assets," he said. "You need to learn to thrive in a world of constant flux," and collaborative networks—both inside your firm but also across process networks in one's broader ecosystem—make that possible by enabling your company to develop new ideas faster than your competitors.

NETWORKED KNOWLEDGE FLOWS

Each of the following three examples illustrates the varied forms learning networks can take. First, a law firm in New York wondered why several recently hired law school graduates were not billing as much as other groups of recent hires. Their cases were being handled in about 25% less time than it had taken older associates when they were at that level. The cases were handled well, but management did not understand the dynamics. "What was happening was that these younger lawyers used Twitter to connect with their cohort group to get information about similar case studies," Seely Brown said. From a single tweet, each lawyer soon had multiple recommendations. "They were spontaneously helping each other fill out their memory gaps; they'd found an interesting way to tap into the collective expertise of this group." The point is, no one designed this collaboration, it just happened. Then the managers decided to "arrange conversations" between the older lawyers and the younger, tweet-savvy lawyers so they could exchange ideas and knowledge. Now they meet on a regular basis. Rather than being structured outside-in, this network arose spontaneously from the inside out.

Another kind of learning network was one Seely Brown observed in his own backyard during the several months a year when he lives in Hawaii. "I've seen an extreme surfboard move travel around the world in 48 hours, all done implicitly with one surfer observing another, filming each other, and then sharing that information on YouTube." Again, these extreme surfing moves, akin to snowboard aerials, were not formally

Models of Value Creation—Characteristics of Stocks and Flows



In today's new digital infrastructure, value is shifting from stocks of assets, such as specific skill sets, to back-and-forth knowledge flows, which allow for capability leverage as opposed to financial leverage.

taught at a school. Each surfer observed, practiced, and maybe changed the move a little bit, went a little more extreme, and passed this knowledge on. Lastly, the SAP Developer Network (SDN) has seen explosive growth since its beginnings in 2002. A blending of social media and SAP software development tools, the SDN uses forums, wikis, and blogs to help users connect and solve problems. Membership rose from 109,000 to 1.4 million in four years. What also happened is that members built up their skill sets and in the process, serendipitously, enhanced their business reputation and hire-ability. And within this network, a question posed was usually answered in less than 20 minutes and then verified within a day or so—a win-win situation for all.

FORECAST: CLOUDS

A large part of this new state of constant flux rests on cloud computing. Being able to buy huge blocks of computing power on a pay-as-you go basis allows you to try out more new ideas. Such fringe ideas, which never would have had a chance if they needed to be pushed into a company's central IT department, can now be tested at a fraction of the cost and time without interrupting the core IT processes. "The cloud computing model lets you get a company started with an American Express card rather than through a venture capitalist," Seely Brown said. Amazon Web Services (AWS) came about because Jeff Bezos wanted more projects done faster. Repeatedly he heard his employees tell him they couldn't finish their projects on time often because of IT infrastructure limitations. So Amazon decided to push the infrastructure out to the edge. The combination of cloud computing and service-oriented architecture supercharges the speed while significantly reducing the cost of innovation and now has become a significant business in its own right. Indeed, another example of the old PARC mantra: build what you need; use what you build; perfect it through use; and then expose it as a service offering to the outside world.

CREATIVE FRICTION

The development of the iPod exemplifies the learning produced from knowledge flows. The idea was initially turned down, but five employees of the company followed the presenter, Gordon Campbell, out the door and formed their own company, PortalPlayer, because they believed in his idea. They gathered together people with the capabilities to build, essentially, an MP3 chip. They got together with Steven Jobs, who was immediately hooked on the idea, but he insisted it be musically precise—you couldn't lose any sound quality when going from a D to an A, for instance. Also, it couldn't use too much power, which, unfortunately, it did. At this juncture, the key role of an orchestrator, someone who can pull all the players together and get them working as a team, comes into play. "When things didn't work out quite right, they came together with these different personalities and different technical capabilities to figure out through the creative power of productive friction how to make this thing actually work. What resulted from all of this creative friction was the emergence of a new idea that was better than the original one. There turned out to be a tremendous amount of learning in this network." The group who thought up the idea of the iPod did not have all the skills they needed to make it a reality, but they knew where to look for people who might have them.

On an organizational level, Seely Brown discussed the global trading group Li & Fung as an example of a global, networked process orchestrator. The company, based in Hong Kong, supplies high-volume, time-sensitive consumer goods, integrating trading, logistics, and distribution. What makes this company powerful as an orchestrator, Seely Brown said, comes from how the company's owners structure their network so it builds trust among all the players. The owners require that their network partners also work with their competitors, and guarantee they'll always take at least 30% but not more than 70% of any one partner's goods. Why? "This

arrangement equalizes the partners so that no one is subservient to another. A tremendous amount of learning happens because there are always going to be little breakdowns." One of the benefits such a network provides is the value of negotiating how to make things work, despite the almost guaranteed breakdowns. The power of this network is the learning that occurs on the fly, which accelerates each partner's ability to innovate in their own spheres.

NEW CREATION SPACES

Another essential tool for operating in the digital learning network infrastructure is creating governance for these new networks. To sustain a learning network, companies will need to write their own governance protocols, just as open source communities do. They need to have in place how to adjudicate differences and resolve disputes. Seely Brown sees this building of constitutional mechanisms as crucial to the success of any company operating in a learning network environment. It's just another form of innovation.

PASSIONATE QUEST FOR KNOWLEDGE

The extreme constraints the iPod developers had in mind for their new product—excellent musical quality with a limited amount of power usage—led to what Seely Brown calls extreme specialization. Being willing to adapt your original idea takes courage and willingness to learn new things. In the case of the iPod, it was moving from multiple chips to an ARM processor core platform. "They went and found the people who put together internal protocols in the device that actually enabled this component as a system to work better together in order to achieve the performance that Steve really wanted," Seely Brown said. The moral of this story is that when things didn't work out quite right, instead of giving up, they pursued their passion for exploration and located the different personalities who had the various technical capabilities needed to make this device work.

Key Points

- Creating networked knowledge flows is the new currency in the emerging digital infrastructure.
- Cloud computing has enabled much faster and cheaper innovation.
- Learning on the fly is the new competitive advantage.
- Trust must be built in the knowledge networks or they will fail.

Profile

JOHN SEELY BROWN

Independent Cochairman, Deloitte LLP Center for the Edge

John Seely Brown is a visiting scholar/advisor to the Provost at University of Southern California and the Independent Cochairman of the Deloitte Center for the Edge. For nearly two decades, he served as Chief Scientist of Xerox Corporation and director of its Palo Alto Research Center—during which he expanded the role of corporate research to include organizational learning, knowledge management, complex adaptive systems, and nano/mems technologies. He cofounded the Institute for Research on Learning and serves on numerous public and private boards of directors. He has published over 100 papers in scientific journals and authored or coauthored numerous books on new forms of collaboration and learning.

Looking Ahead—the View from the C-Suite

John Schanz, Rob Shaddock, and Daniel Zweidler

As noted in Roger Martin's presentation, most of the conference attendees admitted to being unhappy about the level of innovation at their companies. Chief Technology Officers with experience in four industries—cable television, telecommunications, oil and gas exploration, and pharmaceuticals—spoke about the innovation challenges they face, followed by questions from the audience.

Despite the different innovation challenges each of these industries face, panelists and attendees agreed that the most important aspect of any innovation is human capital—the people who work for you. To foster innovation, it is essential to get people talking to each other and break down isolated silos between departments. Recognition of employee achievements is important, whether it is in the form of a bonus or an achievement award; for engineers, sometimes just learning how someone else has used their invention is a reward in its own right. Most participants agreed that, although difficult, breaking free of the "tyranny of the budget"—separating financial discussions from strategy planning—can allow innovation at all levels of an enterprise to flourish.

JOHN SCHANZ

Executive Vice President and Chief Network Officer, Comcast Cable

John Schanz oversees Comcast's engineering and network operations for the company's cable video, high-speed Internet, and digital voice services. He also leads the technology strategy for the deployment of new, complementary communications products and services. Under his leadership, Comcast's products are now delivered over one converged, fiber-rich network that provides service to 22.36 million cable customers, 17.8 million high-speed Internet customers, and 9.2 million voice customers. Prior to joining Comcast, John served as Executive Vice President of Network and Data Center Operations for America Online (AOL), with responsibility for architecture, planning, design, and operation of AOL's global network infrastructure, including the AOL service, Netscape, CompuServe, web properties, messaging systems, telephony, rich media and streaming services, and digital services.

Biggest Innovation Challenge

Reinventing television and improving the customer experience. Consumers want quality picture and sound

and programming, and they want it on their time schedules and on their devices. We have moved from a hardware-centric core to a software-centric core business. The biggest challenge we face in reinventing TV is speed. We are in a very competitive field. Innovation is more than just generating an idea. I tell my boss for every one person he hires who generates an idea, I need 25 more staff people to figure out those ideas. Innovation is a complete cycle from concept to implementation

ROB SHADDOCK

Chief Technology Officer, Senior Vice President,
Touch Solutions for TE Connectivity

Touch Solutions for TE Connectivity is one of the world's largest providers of products and solutions that connect and protect the flow of power and data in virtually every industry. With fiscal 2010 sales of US$12.1 billion, TE Connectivity has approximately 100,000 employees in 50 countries. As CTO, Mr. Shaddock works closely with the company's business unit and technology leaders to enhance TE's overall technology capabilities and ensure full leverage of the company's rich inventory of technologies. He leads the TE Connectivity Engineering Council, which guides the company's overall technology strategy, product development processes, and the overall development of the technology community.

Biggest Innovation Challenge

We build 88 billion parts each year for telecom installations, from 12-foot tall insulators for electrical infrastructure to the tiny circuit protector devices in every cell phone. So we're beginning to think of ourselves as manufacturers, and we want to bring innovation to the manufacturing process to all of our plants across the globe. We are made up of 22 business units. Currently we have a big cultural divide because we are trying to innovate in Asia just as much as we are trying to innovate in the United States and they are completely different cultures. We want to get our innovators from each of our 22 business units to start talking to each other. Building cross-cultural networks and separating our financial discussions from our strategy reviews is one of our biggest challenges.

DANIEL ZWEIDLER

President, Daniel Zweidler & Associates, Inc.

Dr. Zweidler is the Founder and President of an eponymous boutique management consulting firm established in 2011. Formerly Dr. Zweidler was Senior Vice President at Merck & Co., Inc., where he managed the R&D support organization, responsible for guiding strategy formulation, portfolio management, business planning, pipeline execution, and performance review. Following the merger with Schering-Plough he assisted the rationalization of the joint companies' discovery and clinical portfolios, and he also delivered the R&D Enterprise Risk Management plan. Before joining Merck, Dr. Zweidler had numerous positions at Royal Dutch Shell, where he started his career in 1986. During his last assignment as Head, Global Exploration Planning & Portfolio, he advised the Executive President of Exploration, defining Shell's exploration investment case, merging regional exploration realities and imperatives with new country access opportunities and the competitive landscape. Dr. Zweidler is a Senior Fellow at the Mack Center for Technological Innovation at Wharton.

Biggest Innovation Challenge

In the biopharmaceutical arena, to truly innovate we will need to reinvent the precompetitive space. We need to share information about drug failures, because in this industry, you know that you are going to fail with 90% of the novel molecules you test in humans. I think we need to create an ecosystem where we cocreate with the regulatory agencies, with the patients, with the doctors, with the payers, and with other pharma companies. We need to create a public-private partnership where there is no, or limited, IP around a new molecule when it is in

Panelists John Schanz (left), Rob Shaddock (middle), and Daniel Zweidler (right) discussing innovation challenges at the Mack Center conference, The Changing Face of Innovation.

the proof of concept stage. Those in the partnership will have access to all of the information on that molecule for six months before the public at large gains access for example. Companies are spending $7 billion each year to repeat failed experiments. Company after company tests the same type of molecules, even after one company tested it and found that it does not have an effective mode of action. This information is largely not shared because it is viewed as negative information with some perceived degree of competitive advantage. Furthermore, the blockbuster model is currently threatened by the advent of true personalized medicine, which was made more reachable since the completion of the human genome project.

AUDIENCE QUESTIONS

Q: What is the ideal time horizon for innovation planning?

Answers varied, depending on the industry. For the pharmaceutical industry, Daniel Zweidler gave a range of 10 to 15 years "because that's the cycle time it takes to actually bring a molecule to market, to the patient." The energy sector has a much longer time horizon. "We can run scenarios out to 2025 or 2050. We have to be thinking about the next big play after oil, which may be natural gas and then, what's next?"

Q: How do you handle the tension between meeting your quarterly numbers versus spending five to ten years out—the "tyranny of the budget," in other words?

Financial analysts actually view investments quite differently in the oil and gas versus the pharmaceutical industries, Daniel Zweidler said. For instance, if you spent $2.5 billion leasing land in Alaska, analysts will see this as a positive thing because while it may be a long time before you are able to drill and export the oil or gas, you are leasing this land and you are the only one leasing it, creating a barrier to entry for some time. Just

the opposite, though, happens in the pharmaceutical industry, he said. "You're putting your IP into one molecule and it becomes just a horse race as to which company will get the molecule to the market first. Also it's rarely the first molecule in which the mechanism of action is identified that will make it to market. There's usually too much toxicity associated with the first one. So it's actually a lot easier to make an investment case for the long-term in oil and gas than Biopharma R&D. Often analysts will totally discount any R&D investment before Phase III. To them, R&D is largely wasting money."

In the telecommunications industry, Rob Shaddock said, he sees this issue as one not for the CFO but for the technical communities themselves. "We pride ourselves on generating great profits and we spend a lot of time and energy organizationally making sure we continue to do that. Our technicians have great ideas and I want to encourage them to keep innovating." Essentially the challenge becomes learning how to get more efficient at what you are already doing well, he said.

Q: Regarding scenario planning that was discussed earlier today, can you actually predict the black swan or disruptive events? These types of events are becoming more critical because they are fundamental game changers.

One way to anticipate and plan for disruptive events is to ask yourselves: what would put you out of business? The "black swan" events can include natural disasters such as a Hurricane Katrina, a sovereign risk, or the uprising in Libya. Running scenarios of these events should be a conscious effort by top management. Doing so helps build resiliency into your company. "We see ourselves as a service industry," John Schanz said. "Who can tell when a bridge in Minneapolis is going to fall down? With hurricanes, you have some time to prepare at least. We keep ourselves at a level of preparedness in terms of staffing, excess equipment, et cetera. There are three important ingredients—technology, process, and people. But it comes down to our people. In my company, we spend a considerable amount of time on our people because they are the ones who pick the technology and the ones who create the resiliency structurally. We are organized around subteams or teams who are very focused on what they deliver to the customer."

Daniel Zweidler agreed, calling scenarios not "predictions, but a way of living for an enterprise. They are dynamic. You need to be tracking the events in the world that affect your business. When I was with Shell, we decided to go back into Libya and Alaska as a response to the immediate threat, which was that as a corporation, we were too exposed in Nigeria." Under those conditions, spending $2.5 billion in Alaska, even knowing that it could be ten years, or never, that we can drill in Alaska, was seen as a minimal risk, he said. "So you can never predict these black swan events but you can develop a good feel of what could actually happen."

Q: What kinds of processes can be used to accelerate innovation?

In highly regulated pharmaceutical industry, "it is currently very, very difficult to actually share information," Daniel Zweidler said. "The industry needs to be regulated, but information needs to be shared for innovation to happen." Rob Shaddock added that he sees the biggest challenge in creating innovation is simply getting people to talk to each other. "A lot of the 'in-between decision makers' grew up in an environment where information holding was actually seen as a power move, it gave you an advantage." Building the collaborative networks discussed here today is the most important accelerator of innovation.

ABOUT WILLIAM AND PHYLLIS MACK

William L. Mack (Wharton '61) is a former Vice Chair of the Board of Trustees of the University of Pennsylvania and now a Trustee Emeritus. He has served on the Wharton Board of Overseers since 1998 and is presently the Vice Chair, and provided invaluable counsel as a member of the Undergraduate Board beginning in 1989. He was Vice Chair of the Advisory Board of Wharton's Zell/Lurie Real Estate Center. Mr. Mack is the Founder and Chairman of AREA Property Partners, a major global real estate investment company. Mr. Mack is Chairman of the Board of Mack-Cali Realty Corporation, one of the nation's largest real estate investment trusts (REITs).

Mrs. Mack has served on Penn's Institute of Contemporary Art and has hosted many Wharton/Penn events.

ABOUT THE WHARTON SCHOOL

Founded in 1881 as the first collegiate business school, the Wharton School of the University of Pennsylvania is recognized globally for intellectual leadership and ongoing innovation across every major discipline of business education. With a broad global community and one of the most published business school faculties, Wharton creates ongoing economic and social value around the world. The School has 5,000 undergraduate, MBA, executive MBA, and doctoral students; more than 9,000 annual participants in executive education programs; and a powerful alumni network of 88,000 graduates.

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ABOUT THE MACK CENTER

Emerging technologies and technological innovation have the potential to create and transform industries, while simultaneously introducing new risks and uncertainty to established firms. The Mack Center for Technological Innovation, led by Codirectors George Day, Harbir Singh, and Nicolaj Siggelkow, is a Wharton research center that functions as a multidisciplinary learning network for business leaders, academic researchers, and students.

The Mack Center's research community studies how firms compete, survive, and succeed in the face of innovation. They share their findings and knowledge through publications, conferences and workshops, and by providing guidance to decision makers in technology-driven industries.

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