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Real Returns On R&D

It's new products, rather than new processes, that deliver real revenue growth. But the sorry returns on corporate innovation prove that R&D must be more productive, too.

Illustration by
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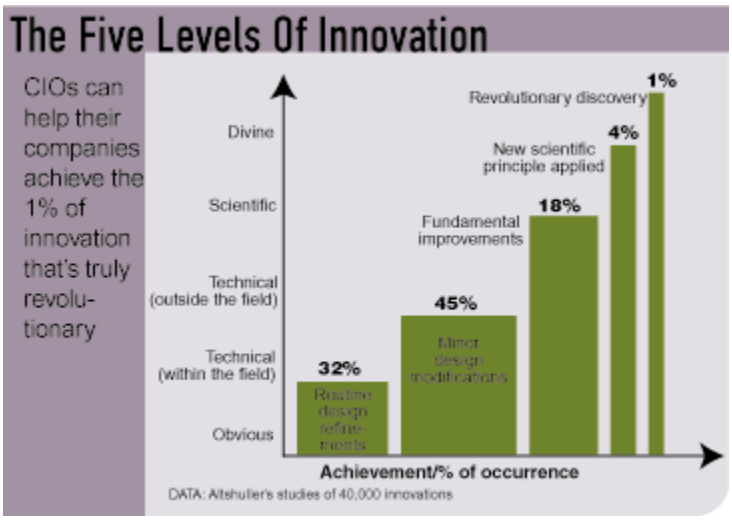
Now that the economy is showing signs of growth and more companies reinvest in the future, corporate leaders face important questions: Will competitive advantage and new revenue growth come from innovations in business processes or in products and services? Is value shifting from new processes to new products? And if so, how can CIOs realign their roles with changing corporate strategies?

In our judgment, old-fashioned product innovation probably is a better investment for most companies—but only if they can consistently improve their innovation process. A better process will bring higher value-producing innovations to market in shorter time frames and commercialize them more quickly to meet better-targeted market needs. That's a winning formula for creating value. It's also the formula that drives the pharmaceuticals industry, which has traditionally placed most of its innovation bets on R&D. It could be the formula for other industries as well, but only if the effectiveness and efficiency of R&D are steadily and substantially improved.

A new methodology called TRIZ, borrowed from engineering, can help CIOs guide their companies in making that shift. The fundamental theory of TRIZ is that innovation isn't about creativity, but about systematically and successfully solving problems in response to human needs and wants, constrained by scientific laws. Companies can deploy the tools of TRIZ to drive their innovation processes to higher levels of performance. Although TRIZ-based tools may be unfamiliar to CIOs, they represent powerful leverage in improving the R&D process. More on that in a minute—but first some background on innovation.



In a 2002 survey conducted by PricewaterhouseCoopers, about half of nearly 1,000 CEOs of major global corporations were optimistic about their revenue growth going forward. The most important business levers expected to drive that improved revenue growth, cited by 40% of respondents, are innovation and unique products and services—innovation by another name. IT and the Internet garnered only a 4% response as a key source of leverage.

CIOs who grasp the importance of this shift in priorities can add measurable value to the innovation process and continue to be viewed as strong, strategic players. They can help the company compete in the battle for revenue and mindshare by bringing management focus and business discipline to this ad hoc and opaque process.

Understanding product research

When it comes to R&D productivity, the bigger part of the problem lies in the "R"—the research—rather than the development. Development has received lots of attention over the past decade: Companies have upgraded their product-development systems; stage-gate decision processes help structure judgments about risky projects; and timely data about real market demand is finding its way into earlier stages of the commercialization process. IT has played an important role in all of these improvements.

But most companies haven't yet improved the product-research process. Too often, business executives fund research without much understanding of where their money is going or how to make the process more productive. That's a major challenge for CIOs and other executives.

Thomas Edison created the first organized and systematic corporate-research model for product innovation with a predictable return on investment at his Central Laboratory in Menlo Park in 1876. As his blueprint was adopted by a broad set of industries—and research became extensive and expensive—hierarchy, structure, and process were added to the model. Along the way, research as a corporate function developed three inherent weaknesses:

The "not-invented here" mind-set. Huge, worldwide investments in technology research mean that no one company can monopolize the field. Yet many remain resistant to innovations from outside their own facilities.

Incremental, not fundamental, innovation. In crowded markets, incremental innovation can help you keep up with the competition, but it rarely creates new markets or substantial gains in market share.

Slow adoption of emerging technologies. Emerging science and technology from outside one's own industry are difficult to embrace, and technologies migrate across industry boundaries surprisingly slowly.

The pharmaceutical industry alone has succeeded in overcoming these weaknesses, and it's been rewarded with spectacular success. Many of its best ideas come from outside sources: academic research centers, teaching hospitals, and medical clinicians. It's turned away from "me-too" drugs to seek breakthrough products. And it's rapidly adopted game-changing approaches to research in biotechnology and genetic engineering through investments in startups and innovative partnerships.

In other industries, the three shortcomings have been much harder to overcome.

In the 1970s, Xerox's Palo Alto Research Center invented many of the central technologies of today's personal computers: desktop computers, client-server architecture, peer-to-peer networking, object-oriented programming, graphical interfaces, laser printing, even the mouse. But Xerox benefited little, because PARC was deliberately disconnected from the rest of the company and failed to commercialize any of its most important inventions. In the '80s, companies tried partnering with academic research centers. Projects like MIT's Media Lab spun out the odd piece of practical technology, but few breakthrough products. By the mid-90s, it became apparent that these initiatives still weren't fueling corporate growth with breakthrough innovations. Many companies turned to entrepreneurial startups; in 2000, corporate-venture investing represented more than 25% of all venture funding made to early-stage companies. But these attempts also failed, and most companies wrote off their venture investments.

Innovation in need of innovation

Perhaps the three pitfalls of innovation adoption are simply here to stay. We think not. But removing them will take significant, fundamental changes.

Consider the case of a major Midwestern consumer packaged-goods company. In 1996, the management team saw the need for a dramatically more-productive R&D effort. The heads of the brand groups knew they could improve their product lines incrementally, but were having difficulty finding fundamental innovation to create new markets, new brands, or substantial market-share gains. The financial community assigned a price-to-earnings multiple that identified the company as a steady, plodding earner.

Five years later, the company has increased its patent production by 300% and is recognized as an innovation leader by competitors, channel partners, and Wall Street. More important, its R&D is yielding products that have established new categories of consumer demand and moved market share against entrenched competitors. Its improved R&D productivity has made all the difference.

The company accomplished all of this by making three basic changes in its research practices:

First, it established a new, powerful communications language between marketing and R&D. Precise functional requirements replaced vague product-need statements and became the lingua franca of the product-development community. Everyone was required to speak it fluently.

Second, the company broadened its search for innovative product solutions to include an extended network of researchers, consultants, and suppliers. Valuable ideas and concepts began to flow from the outside in.

Third, it embraced the heretical belief that innovation can be a structured process. The company trained more than 2,000 engineers in the science-based research methodology TRIZ—a Russian acronym for a phrase that means the theory of inventive problem solving—that brought structure, discipline, and a higher certainty of desired outcome to the search for innovation.

The company contracted with TRIZ experts to demonstrate the power of the methodology by leading a series of breakthrough product-innovation efforts. One of these initiatives resulted in a new product that generated $200 million in sales in its first year of introduction.

This company's experience points the way to putting research on the improved-productivity track. Three basic improvements can be brought to the innovation process, as long as there's pressure for change and a sense of urgency.

Focus innovation on functional requirements and key problems. Most people know that technology innovation in search of a buyer amounts to a lot of wasted effort, but very few know what to do about it. Even bringing the voice of the customer into the research labs is of only limited value, because customers speak with multiple, contradictory voices and usually focus only on incremental product needs. It's the unmet and often unarticulated needs that form the basis of true product innovation.

As the TRIZ community discovered, successful innovation depends on understanding the unmet need as a set of functions to be performed. The client problem can then be systematically deconstructed and traced to a scientific problem statement focusing on the root cause that prevents the need from being fulfilled. This analytic approach sets the stage for a development effort focused on the right target.

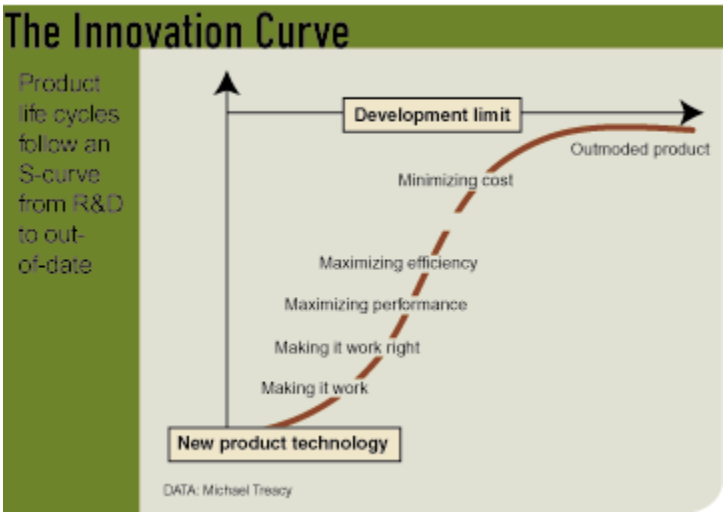
User-requirement analyses are familiar territory for CIOs, and many of the same skills and tools can be applied to innovation initiatives. The organizational insight developed in other business-process improvement efforts will be invaluable in deploying tools such as TRIZ in your company.

Stop looking under the light for innovation. There's an old story about a man searching for his lost keys under the light on a dark night, even though they were last seen elsewhere. When a passerby asks why he continues to search in the wrong spot, the man replies, "Because the light's better over here." Too often, companies search within their own sphere of knowledge rather than seeking solutions wherever they may be found.

Innovative solutions to problems can come from all fields of science, as well as any industry. Open yourself up to looking in the right places with the right questions, rather than looking where it's most convenient. Consider the global scale of knowledge and find ways to tap into this enormous resource pool. Many of the skills that CIOs have developed and used so effectively in outsourcing IT requirements can be transferred to this arena as well.

Bring structure to innovation. TRIZ is the first truly systematic approach to creative thinking since the development of the scientific method. It includes a theoretical base and various analytical and knowledge-based tools to help resolve complex problems in a systematic way.

The use of TRIZ in science and engineering circles to solve manufacturing problems and create new products has been gaining ground since its introduction in the United States just a few years ago. Boeing, Brunswick-Life Fitness, Ford, Philips Semiconductor, and Proctor & Gamble have used TRIZ concepts to solve complex technical problems.



Most companies still associate innovation with creativity, and creativity is an elusive, unpredictable creature. But a study of a large number of patents by a young Russian patent clerk, Genrich Altshuller, and his colleagues found that there are broad, predictable patterns to innovation. And where there are patterns, there's structure. This is the foundation of TRIZ. Altshuller identified 11 trends of evolutionary development—essentially roadways along which successful technical systems tend to develop. The master trend is the S-curve of evolutionary development, which describes the life cycle of a successful system: The system is born, grows slowly as it struggles to gain a foothold, matures as it dominates the market, and finally fades away as it runs up against performance limitations and is replaced by newer systems. Understanding where a system is in its life cycle is key to making business decisions about how and when to invest in innovation.

Because Altshuller approached TRIZ from an engineer's point of view, many of the trends address engineering concerns directly. For example, the trend of dynamization describes how the mechanical

configuration of systems tends to evolve over time. It's desirable, for example, for an umbrella to be broad so it will shield you from rain and also for it to be compact so it's portable. Applying the principle of dynamization makes an umbrella that's broad when it's raining, but folds into a compact shape when it's not.

A TRIZ approach makes you think differently about viewing, analyzing, and resolving problems, and increases your creative abilities. Companies that integrate a continuous TRIZ-based innovation process can attain a sustainable competitive advantage. They'll enhance the innovation skills of a broad cross section of employees; increase productivity; accelerate time-to-market; decrease costs; and improve the quality, safety, and reliability of their new products.

Many of the skills developed to improve other business processes can be deployed to drive change in this new area. By applying proven methods and tools to the R&D process, your company can become an innovation leader that finally makes R&D a productive process.

Michael Treacy is co-founder and chief strategist of Gen3 Partners, a Boston-based professional-services company focused on technology and innovation. His new book, Double Digit Growth (Portfolio), is due in August. James Sims is executive chairman and George Lieberman is CEO of Gen3.

Sidebar: TRIZ Helps Solve The Right Problem

As the former head of Technology Strategy and Planning and CIO of Merrill Lynch, I wish TRIZ had been available when I was trying to make technology-related IT decisions. Most of the problems we now solve using the TRIZ methodology involve complex engineering systems, where a system's fundamental problem is often masked by symptomatic factors. But TRIZ is relevant for IT as well.

One of our clients, for example, was having problems with corrosion in a gas pipeline. Its management asked us to figure out a way to solve the problem by removing the oxygen in the gas flow. After we analyzed the system using TRIZ-based tools, though, we realized that the key problem wasn't the oxygen, but the water.The dissolved oxygen and carbon dioxide in the water were producing carbonic acid; both the oxygen and the carbonic acid were causing the corrosion. TRIZ's function-based approach enabled us to understand the interactions among all the components of the system and to identify the right problem to solve.

In the realm of IT, TRIZ provides a way to systematically test technology solutions to determine which ones are most likely to gain broad adoption and what the best product directions are for the future. As a busy CIO, I would have liked to replace trial-and-error decision making with such a systematic analysis. Even as an IT expert, I wasn't in a position to fully understand which technologies would become the industry standards in years to come. TRIZ could have minimized our investment risks, saved us time and energy, enhanced our strategic recommendations, and helped us to minimize the number of project overruns.

The TRIZ methodology and associated tools would have been a great help when we were challenged by new situations that required innovative approaches by bringing discipline to our thinking.

—George Lieberman