

JUNE 11, 2007



INSIDE INNOVATION -- IN DEPTH  
By Brian Hindo

# At 3M, A Struggle between Efficiency and Creativity

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*How CEO George Buckley is managing the yin and yang of discipline and imagination*

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Not too many years ago, the temple of management was General Electric ([GE](#)). Former CEO Jack Welch was the high priest, and his disciples spread the word to executive suites throughout the land. One of his most highly regarded followers, James McNerney, was quickly snatched up by 3M after falling short in the closely watched race to succeed Welch. 3M's board considered McNerney a huge prize, and the company's stock jumped nearly 20% in the days after Dec. 5, 2000, when his selection as CEO was announced. The mere mention of his name made everyone richer.

McNerney was the first outsider to lead the insular St. Paul (Minn.) company in its 100-year history. He had barely stepped off the plane before he announced he would change the DNA of the place. His playbook was vintage GE. McNerney axed 8,000 workers (about 11% of the workforce), intensified the performance-review process, and tightened the purse strings at a company that had become a profligate spender. He also imported GE's vaunted Six Sigma program—a series of management techniques designed to decrease production defects and increase efficiency. Thousands of staffers became trained as Six Sigma "black belts." The plan appeared to work: McNerney jolted 3M's moribund stock back to life and won accolades for bringing discipline to an organization that had become unwieldy, erratic, and sluggish.

Then, four and a half years after arriving, McNerney abruptly left for a bigger opportunity, the top job at Boeing ([BA](#)). Now his successors face a challenging question: whether the relentless emphasis on efficiency had made 3M a less creative company. That's a vitally important issue for a company whose very identity is built on innovation. After all, 3M is the birthplace of masking tape, Thinsulate, and the Post-it note. It is the invention machine whose methods were consecrated in the influential 1994 best-seller *Built to Last* by Jim Collins and Jerry I. Porras. But those old hits have become distant memories. It has been a long time since the debut of 3M's last game-changing technology: the multilayered optical films that coat liquid-crystal display screens. At the company that has always prided itself on drawing at least one-third of sales from products released in the past five years, today that fraction has slipped to only one-quarter.

Those results are not coincidental. Efficiency programs such as Six Sigma are designed to identify problems in work processes—and then use rigorous measurement to reduce variation and eliminate defects. When these types of initiatives become ingrained in a company's culture, as they did at 3M, creativity can easily get squelched. After all, a breakthrough innovation is something that challenges existing procedures and norms. "Invention is by its very nature a disorderly process," says current CEO George Buckley, who has dialed back many of McNerney's initiatives. "You can't put a Six Sigma process into that area and say, well, I'm getting behind on invention, so I'm going to schedule myself for three good ideas on Wednesday and two on Friday. That's not how creativity works." McNerney declined to comment for this story.

## PROUD CREATIVE CULTURE

The tension that Buckley is trying to manage—between innovation and efficiency—is one that's bedeviling CEOs everywhere. There is no doubt that the application of lean and mean work processes at thousands of companies, often through programs with obscure-sounding names such as ISO 9000 and Total Quality Management, has been one of the most important business trends of past decades. But as once-bloated U.S. manufacturers have shaped up and become profitable global competitors, the onus shifts to growth and innovation, especially in today's idea-based, design-obsessed economy. While process excellence demands precision, consistency, and repetition, innovation calls for variation, failure, and serendipity.

Indeed, the very factors that make Six Sigma effective in one context can make it ineffective in another. Traditionally, it uses rigorous statistical analysis to produce unambiguous data that help produce better quality, lower costs, and more efficiency. That all sounds great when you know what outcomes you'd like to control. But what about when there are few facts to go on—or you don't even know the nature of the problem you're trying to define? "New things look very bad on this scale," says MIT Sloan School of Management professor Eric von Hippel, who has worked with 3M on innovation projects that he says "took a backseat" once Six Sigma settled in. "The more you hardwire a company on total quality management, [the more] it is going to hurt breakthrough innovation," adds Vijay Govindarajan, a management professor at Dartmouth's Tuck School of Business. "The mindset that is needed, the capabilities that are needed, the metrics that are needed, the whole culture that is needed for discontinuous innovation, are fundamentally different."

The exigencies of Wall Street are another matter. Investors liked McNerney's approach to boosting earnings, which may have sacrificed creativity but made up for it in consistency. Profits grew, on average, 22% a year. In Buckley's first year, sales approached \$23 billion and profits totaled \$1.4 billion, but two quarterly earnings misses and a languishing stock made it a rocky ride. In 2007, Buckley seems to have satisfied many skeptics on the Street, convincing them he can ignite top-line growth without killing the McNerney-led productivity improvements. Shares are up 12% since January.

Buckley's Street cred was hard-won. He's nowhere near the management rock star his predecessor was. McNerney could play the President on TV. He's tall and athletic, with charisma to spare. Buckley is of average height, with a slight middle-age paunch, an informal demeanor, and a scientist's natural curiosity. In the office he prefers checked shirts and khakis to suits and ties. He's bookish and puckish, in the way of a tenured professor.

Buckley, in short, is just the kind of guy who has traditionally thrived at 3M. It was one of the pillars of the "3M Way" that workers could seek out funding from a number of company sources to get their pet projects off the ground. Official company policy allowed employees to use 15% of their time to pursue independent projects. The company explicitly encouraged risk and tolerated failure. 3M's creative culture foreshadowed the one that is currently celebrated unanimously at Google ([GOOG](#)).

Perhaps all of that made it particularly painful for 3M's proud workforce to deal with the hard reality the company faced by the late '90s. Profit and sales growth were wildly erratic. It bungled operations in Asia amid the 1998 financial crisis there. The stock sat out the entire late '90s boom, budging less than 1% from September, 1997, to September, 2000. The flexibility and lack of structure, which had enabled the company's success, had also by then produced a bloated staff and inefficient workflow. So McNerney had plenty of cause to whip things into shape.

### **GREEN-BELT TRAINING REGIMEN**

One of his main tools was Six Sigma, which originated at Motorola ([MOT](#)) in 1986 and became a staple of corporate life in the '90s after it was embraced by GE. The term is now so widely and divergently applied that it's hard to pin down what it actually means. At some companies, Six Sigma is plainly a euphemism for cost-cutting. Others explain it as a tool for analyzing a problem (high shipping costs, for instance) and then using data to solve each component of it. But on a basic level, Six Sigma seeks to remove variability from a process. In that way you avoid errors, or defects, and increase predictability (technically speaking, Six Sigma quality has come to be accepted as no more than 3.4 defects per million).

At 3M, McNerney introduced the two main Six Sigma tools. The first and more traditional version is an acronym known as DMAIC (pronounced "dee-may-ic"), which stands for: define, measure, analyze, improve, control. These five steps are the essence of the Six Sigma approach to problem solving. The other flavor is called Design for Six Sigma, or DFSS, which purports to systematize a new product development process so that something can be made to Six Sigma quality from the start.

Thousands of 3Mers were trained as black belts, an honorific awarded to experts who often act as internal consultants for their companies. Nearly every employee participated in a several-day "green-belt" training regimen, which explained DMAIC and DFSS, familiarized workers with statistics, and showed them how to track data and create charts and tables on a computer program called Minitab. The black belts fanned out and led bigger-scale "black-belt projects," such as increasing production speed 40% by reducing variations and removing wasted steps from manufacturing. They also often oversaw smaller "green-belt projects," such as improving the order fulfillment process. This Six Sigma drive undoubtedly contributed to 3M's astronomical profitability improvements under McNerney; operating margins went from 17% in 2001 to 23% in 2005.

While Six Sigma was invented as a way to improve quality, its main value to corporations now clearly is its ability to save time and money. McNerney arrived at a company that had been criticized for throwing cash at problems. In his first full year, he slashed capital expenditures 22%, from \$980 million to \$763 million, and 11% more to a trough of \$677 million in 2003. As a percentage of sales, capital expenditures dropped from 6.1% in 2001 to just 3.7% in 2003. McNerney also held research and development funding constant from 2001 to 2005, hovering over \$1 billion a year. "If you take over a company that's been living on innovation, clearly you can squeeze costs out," says Charles O'Reilly, a Stanford Graduate School of Business management professor. "The question is, what's the long-term damage to the company?"

Under McNerney, the R&D function at 3M was systematized in ways that were unheard of and downright heretical in St. Paul, even though the guidelines would have looked familiar at many other conglomerates. Some employees found the constant analysis stifling. Steven Boyd, a PhD who had worked as a researcher at 3M for 32 years before his job was eliminated in 2004, was one of them. After a couple of months on a research project, he would have to fill in a "red book" with scores of pages worth of charts and tables, analyzing everything from the potential commercial application, to the size of the market, to possible manufacturing concerns.

Traditionally, 3M had been a place where researchers had been given wide latitude to pursue research down whatever alleys they wished. After the arrival of the new boss, the DMAIC process was laid over a phase-review process for innovations—a novelty at 3M. The goal was to speed up and systematize the progress of inventions into the new-product pipeline. The DMAIC questions "are all wonderful considerations, but are they appropriate for somebody who's just trying to...develop some ideas?" asks Boyd. The impact of the Six Sigma regime, according to Boyd and other former 3Mers, was that more predictable, incremental work took precedence over blue-sky research. "You're supposed to be having something that was going to be producing a profit, if not next quarter, it better be the quarter after that," Boyd says.

For a long time, 3M had allowed researchers to spend years testing products. Consider, for example, the Post-it note. Its inventor, Art Fry, a 3M scientist who's now retired, and others fiddled with the idea for several years before the product went into full production in 1980. Early during the Six Sigma effort, after a meeting at which technical employees were briefed on the new process, "we all came to the conclusion that there was no way in the world that anything like a Post-it note would ever emerge from this new system," says Michael Mucci, who worked at 3M for 27 years before his dismissal in 2004. (Mucci has alleged in a class action that 3M engaged in age discrimination; the company says the claims are without merit.)

There has been little formal research on whether the tension between Six Sigma and innovation is inevitable. But the most notable attempt yet, by Wharton School professor Mary Benner and Harvard Business School professor Michael L. Tushman, suggests that Six Sigma will lead to more incremental innovation at the expense of more blue-sky work. The two professors analyzed the types of patents granted to paint and photography companies over a 20-year period, before and after a quality improvement drive. Their work shows that, after the quality push, patents issued based primarily on prior work made up a dramatically larger share of the total, while those not based on prior work dwindled.

Defenders of Six Sigma at 3M claim that a more systematic new-product introduction process allows innovations to get to market faster. But Fry, the Post-it note inventor, disagrees. In fact, he places the blame for 3M's recent lack of innovative sizzle squarely on Six Sigma's application in 3M's research labs. Innovation, he says, is "a numbers game. You have to go through 5,000 to 6,000 raw ideas to find one successful business." Six Sigma would ask, why not eliminate all that waste and just come up with the right idea the first time? That way of thinking, says Fry, can have serious side effects. "What's remarkable is how fast a culture can be torn apart," says Fry, who lives in Maplewood, Minn., just a few minutes south of the corporate campus and pops into the office regularly to help with colleagues' projects. "[McNerney] didn't kill it, because he wasn't here long enough. But if he had been here much longer, I think he could have."

### REINVIGORATED WORKFORCE

Buckley, a PhD chemical engineer by training, seems to recognize the cultural ramifications of a process-focused program on an organization whose fate and history is so bound up in inventing new stuff. "You cannot create in that atmosphere of confinement or sameness," Buckley says. "Perhaps one of the mistakes that we made as a company—it's one of the dangers of Six Sigma—is that when you value sameness more than you value creativity, I think you potentially undermine the heart and soul of a company like 3M."

In recent years, the company's reputation as an innovator has been sliding. In 2004, 3M was ranked No. 1 on Boston Consulting Group's Most Innovative Companies list (now the *BusinessWeek*/BCG list). It dropped to No. 2 in 2005, to No. 3 in 2006, and down to No. 7 this year. "People have kind of forgotten about these guys," says Dev Patnaik, managing associate of innovation consultancy Jump Associates. "When was the last time you saw something innovative or experimental coming out of there?"

Buckley has loosened the reins a bit by removing 3M research scientists' obligation to hew to Six Sigma objectives. There was perhaps a one-size-fits-all approach to the application of Six Sigma as the initial implementation got under way, says Dr. Larry Wendling, a vice-president who directs the "R" in 3M's R&D operation. "Since [McNerney] was driving it to the organization, you know, there were metrics established across the organization and quite frankly, some of them did not make as much sense for the lab as they did other parts of the organization," Wendling says. What sort of metrics? Keeping track of how many black-belt and green-belt projects were completed, for one.

In fact, it's not uncommon for Six Sigma to become an end unto itself. That may be appropriate in an operations context—at the end of the year, it's easy enough for a line manager to count up all the money he's saved by doing green-belt projects. But what 3Mers came to realize is that these financially definitive outcomes were much more elusive in the context of a research lab. "In some cases in the lab it made sense, but in other cases, people were going around dreaming up green-belt programs to fill their quota of green-belt programs for that time period," says Wendling. "We were letting, I think, the process get in the way of doing the actual invention."

To help get the creative juices flowing, Buckley is opening the money spigot—hiking spending on R&D, acquisitions, and capital expenditures. The overall R&D budget will grow 20% this year, to \$1.5 billion. Even more significant than the increase in money is Buckley's reallocation of those funds. He's funneling cash into what he calls "core" areas of 3M technology, 45 in all, from abrasives to nanotechnology to flexible electronics. That is another departure from McNerney's priorities; he told *BusinessWeek* in 2004 that the 3M product with the most promise was skin-care cream Aldara, the centerpiece to a burgeoning pharmaceuticals business. In January, Buckley sold the pharma business for \$2 billion.

Quietly, the McNerney legacy is being revised at 3M. While there is no doubt the former CEO brought some positive change to the company, many workers say they are reinvigorated now that the corporate emphasis has shifted from profitability and process discipline to growth and innovation. Timm Hammond, the director of strategic business development, says "[Buckley] has brought back a spark around creativity." Adds Bob Anderson, a business director in 3M's radio frequency identification division: "We feel like we can dream again."