



TQM, ISO 9000, Six Sigma: Do Process Management Programs Discourage Innovation?

Proof that the premier process management program in American business has crossed over into mainstream consciousness is that a rock band in Northern Kentucky calls itself 6 Sigma. Even those who know more about frets than fractions can explain that Six Sigma is a way of increasing efficiency. A less-alliterative management tool, ISO 9000, also has many fervent adherents but, alas, no rock namesake.

Within the business community, enthusiasm for process management programs such as Six Sigma, ISO 9000 or their predecessor Total Quality Management (TQM) runs strong after two decades. For example, numerous consulting firms still encourage firms to adopt Six Sigma. And despite the mid-summer departure of James McNerney to become chief executive at Boeing, 3M continues to implement the Six Sigma methods that McNerney brought in 2001 from General Electric.

Yet Wharton management professor [Mary J. Benner](#) says now may be the time to reassess the corporate utility of process management programs and apply them with more discrimination. In research done with Harvard Business School professor Michael Tushman, she has found that process management can drag organizations down and dampen innovation. "In the appropriate setting, process management activities can help companies improve efficiency, but the risk is that you misapply these programs, in particular in areas where people are supposed to be innovative," notes Benner. "Brand new technologies to produce products that don't exist are difficult to measure. This kind of innovation may be crowded out when you focus too much on processes you can measure."

TQM, a strategy in which an entire organization is focused on continuous improvement, arose in the 1980s in response to Japanese competition (and the work of W. Edwards Deming) and was popular into the early 1990s. Six Sigma started at Motorola and gained popularity in the mid-1990s largely because of GE's visible efforts. The goal is to improve a company's quality to only three defects per million through systematic incremental change in processes and careful statistical measurement of outcomes.

Six Sigma is similar to TQM in its focus on techniques for solving problems and using statistical methods to improve processes. But whereas TQM emphasizes employee involvement organization-wide, the Six Sigma approach is to train experts (known as green belts and black belts) who work on solving important problems while they teach others in the company.

The focus of ISO 9000, a program started in 1987 by the International Organization for Standardization, is to make sure that companies have standard processes in place that they follow: "Document what you do and do what you document." ISO 9000 involves a third-party registration program (UL -- Underwriters Laboratories -- is one such registrar) certifying that companies are following documented processes.

In addition to these three programs, there are many others that fall under the

general rubric of process management. One aspect they all have in common is that their use has evolved. From the initial 1980s application in manufacturing, they are now used in many industries and within many corporate divisions.

"Light-bulb Moments of Brilliance"

Benner's work on process management and innovation -- a subject she and Tushman have been studying since 1998 -- is attracting new attention. She suggests two reasons: "I suspect that many companies with widespread process management initiatives over the past few years have reached the limits of improvement." In addition, the ability to gain competitive advantage from cost and efficiency gains also has limits. Once a firm's competitors are adopting the same practices, it is difficult to have competitive advantage longer term. "Companies need other advantages, such as new innovation."

Today, companies ranging from IBM to pharmaceutical firms to consumer product manufacturers such as Procter & Gamble and Unilever have acknowledged a renewed attention to gaining advantage through innovation. Even General Electric -- the symbol and evangelist of Six Sigma discipline -- is looking to grow through exploratory innovation. As companies focus on gaining competitive advantage through innovation, research on how and why innovation flourishes is significant.

Benner and Tushman's 2002 paper, "Process Management and Technological Innovation: A Longitudinal Study of the Photography and Paint Industries," looks at patenting activity in two industries that rely on process management. Their underlying question was whether the discipline of process management will fertilize or strangle those new ideas that come from light-bulb moments of brilliance. "Our results suggest that exploitation" -- building on a firm's existing knowledge -- "crowds out exploration," the authors write.

Benner and Tushman examined the photography and paint industries from 1980 to 1999, choosing these two industries for differences in their competitive arenas. "Photography was undergoing major change. It was a turbulent environment and there was a potential need for innovation," says Benner, referring to the move from chemical-based film to digital technology. "Paint was focused on cost reductions. It was trying to reduce solvents in paint as opposed to developing wacky new stuff."

The authors looked at the number of ISO 9000 quality program certifications obtained by the paint and photography firms, the numbers of patents issued to the firms and "the extent to which a firm's patenting efforts built on knowledge it had used in previous patents." In photography, increased ISO certifications were associated with "a significant decline in the number of patents that were based entirely on knowledge new to the firm." In paint, the effect was not as strong but echoed the photography industry's disappointing experience. The results suggest, the authors write, "that in both the paint and photography industries, as process management activities increase, exploitation increases at the expense of exploratory innovations."

And even exploitation is hamstrung. In the photography industry, Benner and Tushman found that patents that relied up to nearly 40% on previously acquired knowledge were squeezed out in favor of patents based 80% or more on existing firm knowledge. "These results suggest that firms' challenges in maintaining exploration may be more difficult than previously suggested," the researchers write. Organizations already find it hard to sustain highly risky search and exploration into

new domains, but it appears that this difficulty "extends even to sustaining moderately exploratory innovations that leverage existing organizational knowledge."

In their paper, Benner and Tushman propose that in the photography industry, "the dampening effect of process management on exploratory innovation may have implications for adaptation to subsequent transitions in technology." As examples, they speculate whether the slow response at Polaroid and Kodak to the digital revolution in photography may have been linked to organizational inertia rooted in their attempts to exploit expertise in film.

Benner knows first-hand how performance management measurements can be knitted into the fabric of a company and produce positive results. As an executive with Honeywell from 1989 to 1996, "I thought it was useful to map processes for how to run a business and get better at it. The view was that these are universally good things. When I left to get my PhD, I began to consider the effects on innovation. What does it do to new knowledge creation?" She started exploring these ideas as the prior enthusiasm for TQM -- triggered by the intense competition from Japanese manufacturing in the 1980s -- was waning, but enthusiasm for ISO 9000 and Six Sigma was building.

Because process management practices focused on increasing efficiency or taking out wasted steps are important for companies in the highly competitive global market, "there will always be pressure on firms to adopt programs that help them systematically improve their current business, whether the popularity of Six Sigma per se diminishes or not," says Benner.

Yet companies are making room for other imperatives. Chief executive Jeffrey Immelt, for instance, has set GE on an ambitious course of growing more revenue from existing operations. This growth is fueled by radical technological innovation, or what he calls "imagination breakthroughs" proposed by his executive team -- whose annual bonuses are partially tied to meeting marketing, sales and idea-generation goals. Immelt has invested \$100 million in revitalizing GE's research center in New York and spent millions for centers in Munich, Shanghai and Bangalore. He has encouraged his managers to take risks even when that means risking failure, Benner says.

An "Ambidextrous" Approach

Changing the culture at GE or any established company to embrace long-term innovation will be challenging, Benner acknowledges. "Most managers know they must do this. But there are few short-term rewards for focusing on long-term. When you give people a choice of something that's new and distant in time, they will choose the short-term, measurable goal.... You can get stuck being very, very good at something you were good at yesterday. That's what some managers choose because it is measurable."

Measuring innovation is not easy because there is no yardstick. Rewarding innovation makes compensation a tricky exercise. Managing those who innovate is also challenging. "Creative people will push back in an environment where people are required to follow standard processes and are being measured," says Benner. "People who are comfortable in such an environment are not exactly the most innovative."

Benner doesn't suggest that companies abandon the process management principles, but rather that they apply them where most appropriate. In their study, she and co-author Tushman recommend "a more nuanced approach to creating organizations that can celebrate both variance reduction in the service of exploitation and variance creation in the service of exploration."

Companies need to balance two types of activities: improving current operations to be competitive in the short term, and exploring for new knowledge for the future. Swinging back and forth between enthusiasm for process management or for new innovation, says Benner, doesn't achieve the balance. Too much process management across all levels of an organization makes it easier to implement but can strangle bolder, breakthrough innovations. Conversely, it's difficult to focus on systematic, continuous improvement in quality and cost if the entire organization is focused on big innovations for the future.

It is important for senior managers to be aware of this dilemma and exercise care about extending Six Sigma-like programs into all areas of their organizations. Instead, Benner and Tushman recommend that companies become "ambidextrous" - managing process management and innovation simultaneously. Individuals who run business units must be able to manage the inconsistency of separate areas of an organization focused on fundamentally different activities. Within a business unit, managers can specialize in either more process-oriented functions with the benefits of Six Sigma efficiency or more innovation-oriented activities without Six Sigma constraints.

This innovation can happen in both the R&D department, where companies are generating new ideas or creating new products, and in marketing, where companies search for new markets and new customer sets.

Companies may be tempted to apply process management approaches to ensure that they are "improving" how they innovate or find new markets. But innovation may not lend itself to strict processes with measures. For example, Benner says, if a company typically applies for patents for its big, potentially important innovations, and then implements a process management approach to improve its patenting process, it may end up gauging success by looking at change in the number of patents it applies for. It may indeed get a larger number of patents, but these patents may each be less innovative, more incremental, and less important. It is more difficult to measure the innovativeness of each patent than it is to count patents.

Above all, firms today must recognize that process management programs do have limitations. Says Benner: "Our message is this: Companies that have process management in one area must realize that it can bleed into other areas of the company, and you must prevent that from happening. Use these approaches where they make sense -- and deliberately do not have them in areas that are focused on innovation."

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