



Katherine Radeka

Why Six Sigma experts are wrong for product development—Here's the proof

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Everyone has been talking about “lean” product development for several years and trying to apply it to new product development (NPD). More recently, people have started to ask how Six Sigma factors in, especially when both techniques are tied to NPD. In this article, the author takes on this topic. Her article follows an extensive overview on “lean” she wrote with coauthor Tricia Sutton that was published in the June 2007 issue of *Visions*.

Six Sigma is a methodology for continuous improvement that has gained significant momentum in the past five years, and it may soon arrive at a product development organization near you. Will it hurt? Can it help? What are all of those colored belts?

What is Six Sigma?

Motorola developed Six Sigma in the 1990s to provide a corporate-wide focus on quality management. Then, Jack Welch of General Electric (GE) embraced Six Sigma and drove it into every GE business unit. Six Sigma draws from the works of W. Edward Deming and other quality management experts, as well as from the research on how to achieve change at the corporate level to articulate a clear path for

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any organization that wants to make measurable improvements in quality, efficiency, and cost.¹ Six Sigma, like all process management and continuous-improvement methods, has its roots in the operations research conducted, beginning in the 1920s, by W. Edwards Deming, Walter Shewhart, and others. When American audiences in the 1950s were resistant to the lessons that emerged from this research, Deming went to Japan, where he found a willing student in Taichi Ohno of Toyota.

In the 1980s, when Japanese cars began to threaten the U.S. auto industry, these ideas became popular in the United States, where they became known as Total Quality Management. Direct studies of Toyota's production system led to Lean Manufacturing. ISO9000 is a certification program that validates whether or not a company has good process management procedures in place.

Six Sigma was Motorola's approach for implementing quality and process management across a very large organization with tops-down, metrics-driven accountability for results. Like all of these methodologies, Six Sigma has its own language. Six Sigma experts earn “belts,” from green belt to master black belt, and get promoted to new levels based on successful project completions. In the language of Six Sigma, Define-Measure-Analyze-Improve-Control (DMAIC) is the process used to improve a process—a process according to Six Sigma authors and speakers.

However, people employing Six Sigma usually encounter significant resistance when they move their work into engineering or marketing, the two key players in product development. “We're different,” new product development (NPD) practitioners say. “We have to have the freedom to be creative.” Some Six Sigma experts decry this lack of “process discipline.”

Process management in times of change

Mary J. Benner, Professor at the Wharton School of Business at the University of Pennsylvania, has actually studied the effects of process improvement and process management programs on technological innovation and the ability to adapt to changing markets. For the last 10 years, Benner has looked at the photography industry, watching as photography and consumer electronics companies navigated the shift from film to digital photography. To observe the effectiveness of product development, she has examined 20 years of patent applications and their more recent product releases. In 2002, she published her initial findings, which noted that companies with strong process-management programs released more patents, but that many more of those patents represented only incremental improvements rather than breakthrough ideas.²

In a research paper for PDMA's *Journal of Product Innovation Management* that will be published later this year, Benner observes that those companies with strong process management tools in the photography industry had a more difficult time managing the transition from film to digital, while those in the consumer electronics industry had an easier time.³

During an interview for this article, Benner theorized that moving from film to digital photography required a lot of flexibility, whereas a digital camera is an incremental move for a consumer electronics company, especially a printer company like Hewlett-Packard, since the technology and the business model are highly leverageable.

3M and Six Sigma

For direct evidence of the difficulties that a product development group has with Six Sigma, look no further than 3M. In the 1980s and early 1990s, this company was renowned for its unique approach to innovation, fostering products such as Thinsulate® and the ubiquitous Post-it Note®. However, by 2000, the mood had shifted away from corporate laboratories. When James McNerney lost the battle to succeed Jack Welch at GE, 3M enthusiastically

embraced him. One of his key objectives was to improve the efficiency of 3M's innovation process to reduce the effort spent on finding that next big idea.

McNerney instituted a classic enterprise-wide Six Sigma program with improvement objectives from the top down and in every area of the organization. The Six Sigma corporate team salted the organization with Lean Six Sigma Black Belts, people whose full-time jobs were to identify process improvement opportunities in their business areas and lead projects to implement them. Research and development was one of the major focus areas for improvement.

Their results? According to a September 2007 article in *Business Week* magazine, the results were unimpressive to say the least.⁴ Although the programs definitely improved

operational efficiency in manufacturing, finance, and similar organizations, 3M's celebrated research and development programs had slowed. After a long history of gaining more than a third of their revenue from new products, today new products at 3M account for less than a quarter of its revenue.⁵ McNerney departed this past year from the company. His successor, George Buckley, has wound down many of the Six Sigma efforts and exempted 3M's research scientists from the need to fulfill Six Sigma-driven objectives. The Lean Six Sigma Black Belts are being reabsorbed back into their organizations.⁶

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Why Six Sigma doesn't work in product development

The underlying research and the subsequent results show that these methodologies can lead to dramatic improvements in operational efficiency. However, product developers are right to be suspicious of corporate continuous-improvement programs. The key word is “operations,” and product development differs from the rest of the organization's operations in important ways that make it vulnerable to undesirable side effects from too much process management. Exhibit 1 summarizes the differences between operational processes and knowledge-creating processes like product development.

In an operational process, the organization knows the detailed outcome from the very beginning. For example, make 100 widgets that are exactly like this widget, with only small variances between individual items, or, every potential customer who makes an inquiry should receive an information package within one week.

Contrast that to the typical charters given to a new product development team: Find our next big growth opportunity or design a new product for the spring 2010 market window. A team may go in knowing almost nothing about the end result, and the effort to create the knowledge that will generate a completed product design can take years.

In that environment, teams need the ability to stay flexible as long as possible and explore a range of alternatives. Every team's journey to the final solution will be at least a little bit different from the last team's journey. In a rapidly changing environment, there is no such thing as a stable product development process.

This does not mean that teams are free to do everything their

Exhibit 1: Differences Between Operational Processes and Knowledge-Creating Processes

Characteristic	Operational Processes	Knowledge-Creating Processes
Knowledge	Instantiate knowledge to achieve a specific result	Develop knowledge to deliver new capabilities
Cycle time	Minutes to weeks	Weeks to years
Inputs	Raw materials	Information
Output	Finished product	Knowledge as manifested in a product design
Certainty of outcome	Very clear from the beginning	Very fuzzy at the beginning—becomes more clear over time
Repeatability	Make many copies of the same thing—variation is waste	Create a unique product—some variation is essential for innovation
Rework	Rework and loopbacks point out waste to eliminate	Rework and loopbacks may indicate new learning
Examples	Manufacturing, accounting, sales	Strategy, marketing, engineering

SOURCE: The Author

own way with no constraints. It is helpful for these teams to have a high-level framework, such as Robert Cooper's Stage-Gate process to help them work toward intermediate objectives. Additionally, hard deadlines work wonderfully as motivators to help a team converge on a solution. As the team moves through the Fuzzy Front End to the more defined stages later in development, predictability increases and variability decreases. Exhibit 2 shows how the need for flexibility decreases throughout the product life cycle, and suggests some methods that can help improve product development performance at each stage.

At every stage of the process there are those day-to-day things that should be done as efficiently as possible: preparing status reports for senior managers, managing the team's defect tracking system, and so on. These "microprocesses" are often rich sources of efficiency improvement in product development because they take away significant amounts of time that the marketing and engineering staff can spend creating knowledge and delivering customer value.

Creativity vs. process management: the right balance

What can you do when the Six Sigma Black Belts from the corporate office knock on your door?

Make use of the offer to help, but set clear scope boundaries based upon which aspects of your product development process are truly routine and which ones require variability to work properly.

Ask the Black Belts to read some of the latest thinking about lean product development such as the aforementioned article in the May 2007 issue of *Visions*, to give them a feel for how product development differs from the types of processes that they may know more intimately.

Encourage the Black Belts to help you improve those microprocesses that are a constant source of irritation and wasted effort as a way to build trust with the engineers and marketing staff, which lays the groundwork for a more comprehensive look at the overall product development framework.

Resist their efforts to create a map of the product development process until they have demonstrated that they understand the need for variability within product development, and their ability to avoid diving into program-specific details. If the first words out of their mouths are "we have to stabilize the product development

process before we can improve it," they are not ready to engage with your teams in a useful way.

Resist their efforts to create a detailed process map of a single product development program, period. Unfortunately, this is a recommended best practice in some circles, but it takes a lot of time and rarely generates useful data. Point out that every product development program would have a different map at the detailed level, so the information gained is not transferable across programs.

Once they have demonstrated that understanding, make use of their expertise to help remove unnecessary waste from your product development framework by streamlining such things as requirements management and project status reporting.

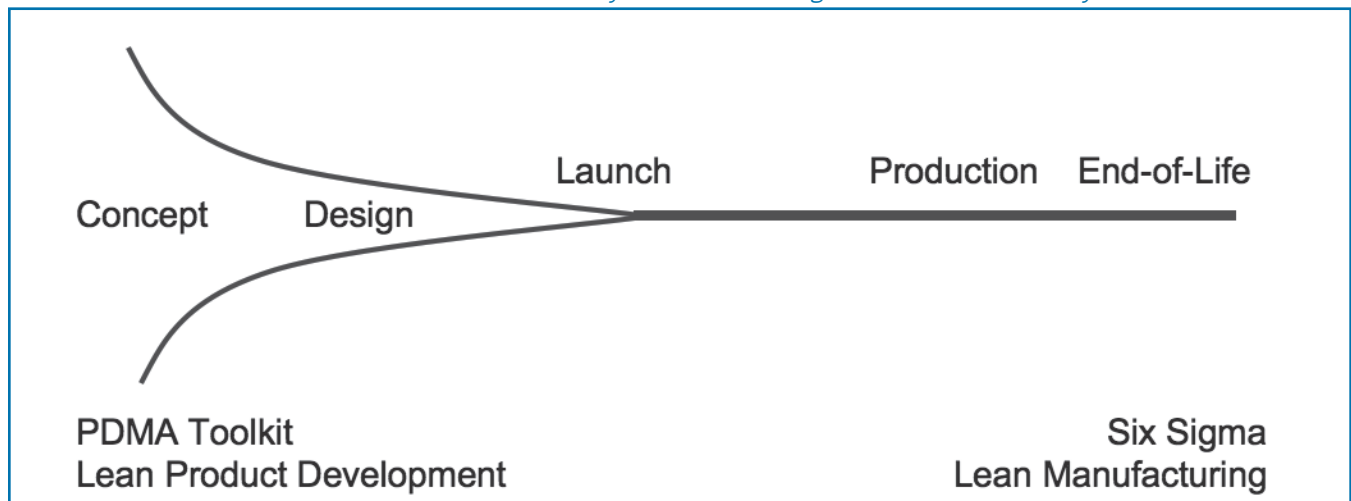
The good news is that the people attracted to Six Sigma programs are often there because of their willingness to learn new things and to grow their expertise, and they have a deep commitment to organizational improvement. Once they have spent some time in product development getting the lay of the land, they will be able to adapt their toolkit to help their product development organizations operate more effectively and efficiently. §

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Endnotes

1. Jeroen deMast, "Integrating the Many Facets of Six Sigma," *Quality Engineering*, 19:4 (2007).
2. Mary J. Benner and Michael Tushman, "Process Management and Technological Innovation: A Longitudinal Study of the Photography and Paint Industries," *Administrative Science Quarterly*, 47: 676-706, 2002.
3. Mary J. Benner "Dynamic or Static Capabilities? Process Management Practices and Response to Technological Change," *Journal of Product Innovation Management*, (forthcoming 2008)
4. Brian Hindo, "3M: Struggle between Efficiency and Innovation," *Business Week*, September 14, 2007.
5. Ibid.
6. Ibid.

Exhibit 2: The Need for Flexibility Decreases Throughout the Product Life Cycle



SOURCE: The Author