Six Sigma

Matt Barney
Motorola

Six standard deviations from the mean—yeah, right! That might be your first reaction to this month’s Macro, Meso, Micro title. But keep reading—I promise you it’s much more than Dunnette’s famous “Fads, Fashions & Folderol” (Dunnette, 1966).

Motorola created Six Sigma in 1986 to address quality problems. One engineer famously stood up at a company meeting and said, “Motorola’s quality stinks.” Customers complained that Motorola’s products were unreliable and bug-ridden, and responded by flocking to the competition. Motorola CEO at the time, Bob Galvin, responded by pulling together statisticians and engineers to create scientifically based problem-solving methods, using good project management techniques. Ultimately, the goal was to design and improve organizational processes such that product defects were extremely rare. So rare are “Six Sigma” process problems, that there are fewer than 3.4 “defects” per million opportunities to create a problem. This equates to defects falling outside six standard deviations from the mean, on a normal curve (99.99966% for those of you rushing to check your z-charts).

It’s hard for psychological interventions to achieve such near-perfection, but in physical sciences, this is not only feasible; it solves a seemingly impossible tradeoff. In Six Sigma, the scientific method is applied to processes to reduce the likelihood of mistakes. As a result of this research, processes are improved to the point where they use resources optimally, and produce almost no waste. Since there is very little waste in an optimized process, the costs of the process are also simultaneously lower.

Six Sigma projects are done in the context of an overall approach to improving the business, called a “Business Improvement Campaign.” In a Six Sigma campaign, employees and leaders are trained in a variety of statistical methods, project management, process design, and problem-solving techniques. Once they have demonstrated their effectiveness at applying quantitative methods to business problems, they receive “Green Belts” and “Black Belts”—terms borrowed from the martial arts.
Stractics and The New Six Sigma

After Motorola initially achieved success with Six Sigma, Jack Welsh, the new General Electric CEO at the time, promulgated Six Sigma as a set of analytical techniques for leaders to use while managing their businesses, not just in the factories. Since then, Six Sigma has become a $200 million consulting business in North America alone (S. Hanley, personal communication, February 2, 2002).

Today, Motorola has transformed traditional Six Sigma into a combination of macro-organizational strategy and meso and micro tactics. Our strategic planning processes use balanced scorecards to communicate and measure our overall organizational approach to winning. On our scorecards, we identify business outcomes and process improvements that are required to realize the strategic goals. Executives serve as champions for scorecard improvements, and “Black Belts” are the ideal project leaders who mentor junior “Green Belts” in statistical problem solving. We integrate scorecards, process measures, and project metrics into a systemic review process to help leadership manage the organization quantitatively. We call this overall process of executing the strategy “Stractics,” because it translates the business strategy into tactical tasks.

Reinventing Six Sigma

Traditionally, Six Sigma was a successful quantitative alternative to the faddish 1980s “Total Quality Management” (TQM). Today, Motorola has learned that Six Sigma is useful in domains other than just product quality improvement and cost reduction. In the past, Six Sigma methods were used to make improvements based on customer feedback. But if you use Six Sigma methods on a set of terminally unprofitable customers you may miss the overall market opportunity. Also, in the past, Six Sigma methods were used to accomplish goals that the market doesn’t care about. For example, Motorola cell phones are just as reliable in Chicago winters and Amazon-rainforest summers—arguably much more reliable than our competitors. But if your cell phone breaks, who cares when you can get a new one for free? The new Six Sigma is used as a set of improvement techniques on any part of your business, not just the myopic focus on product quality.

Another important difference from TQM is that Six Sigma doesn’t try to introduce continuous improvement for its own sake. Modern Six Sigma uses the rigor of the scientific method, good problem solving, and project management to make business improvements wherever required by the business strategy. Today’s improvement projects aren’t limited to product quality and process improvement problems anymore. Finance, marketing, and HR are all good candidates for using Six Sigma methods, if needed. Similarly, Six Sigma is no longer limited to situations where calculating the famous defect levels is helpful.
Six Sigma and I-O Psychology

The new Six Sigma presents unique opportunities for I-O psychologists. First, to gain a seat at the strategic decision-making table, we need better ways to show the connection between our interventions and business outcomes. Six Sigma is based on the scientific method, and also includes problem solving and project management methods required to successfully implement an intervention. We I-O psychologists often don’t get formal development in project management or structured problem solving, and Six Sigma methods can be helpful in ensuring our systems are implemented on time, at cost, and with good effect sizes. In this way, Six Sigma can be a useful methodology to structure our own applications of science. Using the language and frameworks of Six Sigma can immediately help others appreciate our suggestions about improving employee performance in organizations.

Second, it’s inevitable that Six Sigma will increasingly be applied in human-intensive processes. Six Sigma experts are starting to realize that attributes of work and workers are the key drivers of business outcomes in consulting, medicine, biotechnology, and other “knowledge worker” processes. As non-I-O psychologist practitioners apply Six Sigma methods to processes where people make the difference, I have found them to be very appreciative of our expertise. In part, this is because traditional statistical experts and engineers know little or nothing about I-O theory or quantitative tools. When I’ve explained the quantitative methods in our toolkit—like psychometrics or latent variable models—they are very interested and become conscientious about using I-O theory and methods in their improvement projects. As a discipline, I believe I-O psychology would benefit from nurturing relationships with scientist–practitioners from kindred disciplines to increase the likelihood that our interventions make a difference. Further, in the new Six Sigma, making a difference doesn’t have to force-fit into a “Six Sigma” defect calculation.

Similarly, our discipline can benefit from statistical methods from other quantitative disciplines prominent in classic Six Sigma. These techniques can give us new methods to analyze micro-level behaviors in the context of meso-level processes and macrooutcomes. For example, when industrial engineers optimize processes, they use a set of quantitative techniques called stochastic models. These models help one to understand the flow of work tasks across workers, equipment, and technology, which can optimize the overall performance of the system. Stochastic methods can be useful to us in understanding task interrelationships between and within jobs in a process. Similarly, response surface methods are standard statistical techniques used to identify the “sweet spot” between a set of independent variables, and some dependent measure of interest. Classically, Six Sigma Black Belts do experiments to understand the effect of varying the levels of gauges or temperatures and to identify the combination that gives the high-
I believe these methods can assist our ability to quickly find “sweet spots” in I-O interventions, and communicate the results. For example, when we do quasi-experiments, for example in designing training across media, regions, and instructors, response surface methods can be helpful for us in graphically depicting what levels of human resource-independent variables will maximize training effectiveness. This can be invaluable for communicating our recommendations to executives and managers.

Conclusion

Six Sigma is a science-based set of interdisciplinary methods that are worthy of I-O psychologists’ attention. Importantly, they can give us an entry point into the boardroom, as we’re the scientists of people at work—a domain increasingly of interest to practitioners of Six Sigma. They also give us new methods—quantitative and problem solving—that can help us better integrate our work with scientist-practitioners from other disciplines.

Please keep e-mailing your comments and suggestions. You can reach me at matt.barney@motorola.com

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