

Motorola's Second Generation

AT THE PLACE IT
WAS BORN, SIX
SIGMA HAS EVOLVED
INTO A 4-STEP, HIGH
PERFORMANCE SYSTEM
TO EXECUTE BUSINESS
STRATEGY.

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Motorola Inc. invented Six Sigma, and we have learned a great deal about it over the last 15 years. During that time, Six Sigma has evolved from its roots as a measure of quality to an overall business improvement methodology.

Origins

In 1986, Bill Smith, a senior engineer and scientist within Motorola's Communications Division, introduced the concept of Six Sigma in response to increasing complaints from the field sales force about warranty claims. It was a new method for standardizing the way defects are counted, with Six Sigma being near perfection.

Smith crafted the original statistics and formulas that were the beginnings of Motorola's Six Sigma methodology. He took his ideas to CEO Bob Galvin, who was struck by Smith's passion and came to recognize the approach as key to addressing quality concerns. Six Sigma became central to Motorola's strategy of delivering products that were fit for use by customers.

Following a common Six Sigma methodology (measure, analyze, improve and control) Motorola began its journey of documenting key processes, aligning processes to critical customer requirements and installing measurement and analysis systems to continuously improve the process.

As a result, in 1988 Motorola became the first company to win the Malcolm Baldrige National Quality Award. In 1990, Motorola—together with companies such as IBM, Texas Instruments and Xerox—created the concept of Black Belts (BBs), who would be experts in applying sta-

Table 1. **Contrasting Six Sigma and Total Quality Management**

Six Sigma	Total quality management
Executive ownership	Self-directed work teams
Business strategy execution system	Quality initiative
Truly cross functional	Largely within a single function
Focused training with verifiable return on investment	No mass training in statistics and quality
Business results oriented	Return on investment
	Quality oriented

tistical methods. Later, AlliedSignal (now Honeywell International Inc.) and General Electric Co. successfully applied and popularized Motorola's Six Sigma methodology as part of leadership development.

From Quality to Business Improvement

While Six Sigma was originally created as a continuous quality improvement technique, today it is significantly different than the total quality management (TQM) approach of the 1980s. Table 1 (p. 13) shows the key differences between Six Sigma and TQM.

From our extensive experience, Motorola has learned Six Sigma goes far beyond counting defects in a process or product. The next generation Six Sigma is an overall high performance system that executes business strategy. Experience leads us to the insight that Six Sigma demands the following four steps:

1. Align executives to the right objectives and targets.
2. Mobilize improvement teams.
3. Accelerate results.
4. Govern sustained improvement.

Step 1—Align

The new Six Sigma starts with senior executives creating a balanced scorecard of strategic goals, metrics and initiatives to identify the improvement points that

Figure 1. Scorecard Development Process

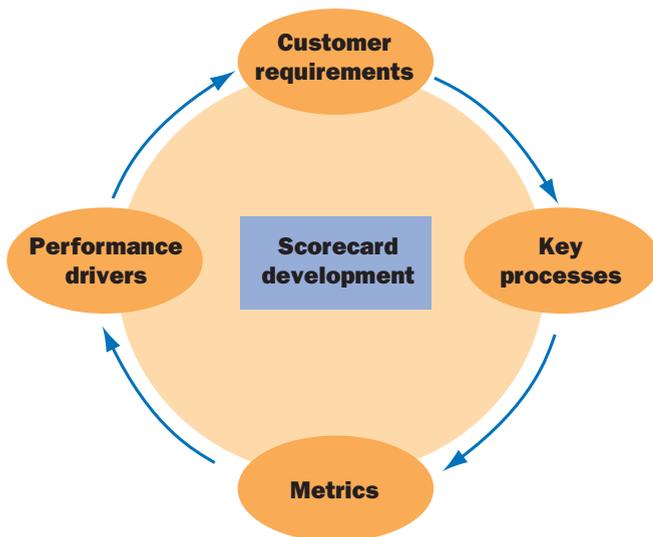
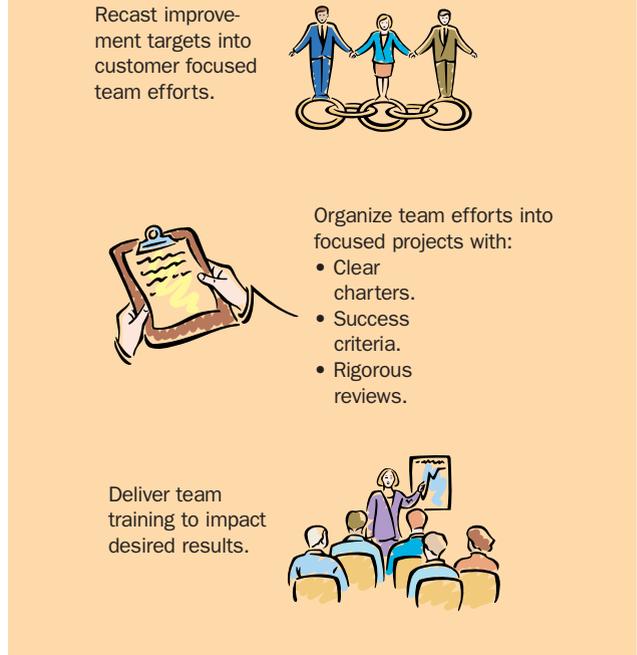


Figure 2. Mobilizing for Six Sigma



will have the most effect on the organization's bottom line (see Figure 1).

Critical scorecard metrics drive stretch goals for the various business processes owned and supervised by senior executives. Process owners champion the creation of high impact improvement projects to realize the strategic goals.

In the second generation Six Sigma at Motorola, processes are not limited to the classic product and service domains. They can involve market share improvements, better cash flow and improved human resource processes. Executives select and supervise a handful of improvement projects by releasing constraints in business processes that cause critical business gaps.

Step 2—Mobilize

Customer focused project teams are formed and empowered to take action (see Figure 2).

Executive process owners empower BBS to lead well-defined improvement projects. Six Sigma business improvement teams use:

- A systematic problem solving method to

frame the sequence of project tasks.

- Analytical techniques to drive fact based decision making.
- Interventions to sustain business impact.

The step by step problem-solving framework and work breakdown structure can be remembered easily by using the acronym DMAIC:

- First, the business problem is **D**efined to determine what needs to improve.
- The team then **M**easures the current state against the desired state.
- The team **A**nalyzes the root causes of the business gap.
- The team then brainstorms, selects and implements the best **I**mprovement solutions.
- Last, the team **C**ontrols the long-term sustainability of the improvements by establishing monitoring mechanisms, accountabilities and work tools.

In the traditional form of Six Sigma, the measurement focus was on the number of defects per million opportunities (DPMO), which is used to calculate the Six Sigma metric.

Today, while we can still use DPMO and Six Sigma calculations, they are not desirable in some situations, particularly human intensive processes such as marketing and human resources.

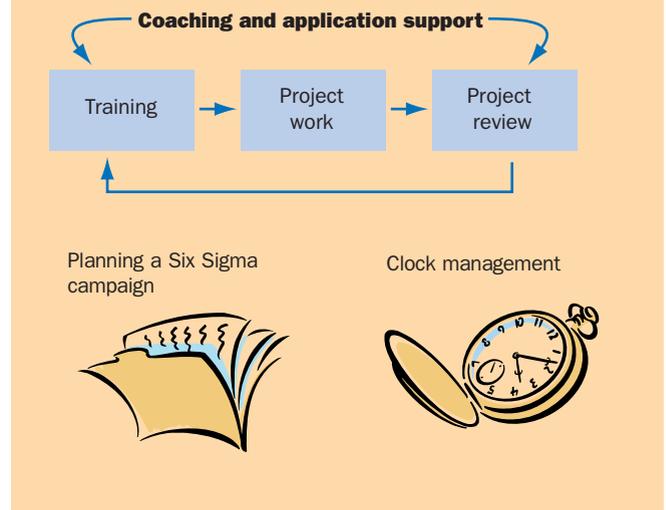
In the case of human resources, the definition of a defect, such as employee performance that falls below a certain level, can be controversial and can also be manipulated to get a better sigma value.

For all measures with the second generation Six Sigma, the focus on defects and sigma levels is less important. The emphasis is on using variable (continuous) data whenever possible rather than attribute data.

Continuous data provide more information about the process for a given sample size, and the use of continuous performance metrics, such as capability indices, provide a faster and less costly road to obtaining Six Sigma levels of quality. This concept is particularly important for service and transactional processes, in which the data historically collected has been attribute data in the form of counts or percentages.

For example, metrics, such as the number of overdue invoices in an invoicing process or the percentage of dissatisfied customers in a credit approval process, can be replaced with continuous metrics, such as invoice delivery time or credit approval response time.

Figure 3. Accelerating Six Sigma



Often, customer requirements will generate specification limits that we can use to compute capability indices rather than DPMO and Six Sigma numbers.

Step 3—Accelerate

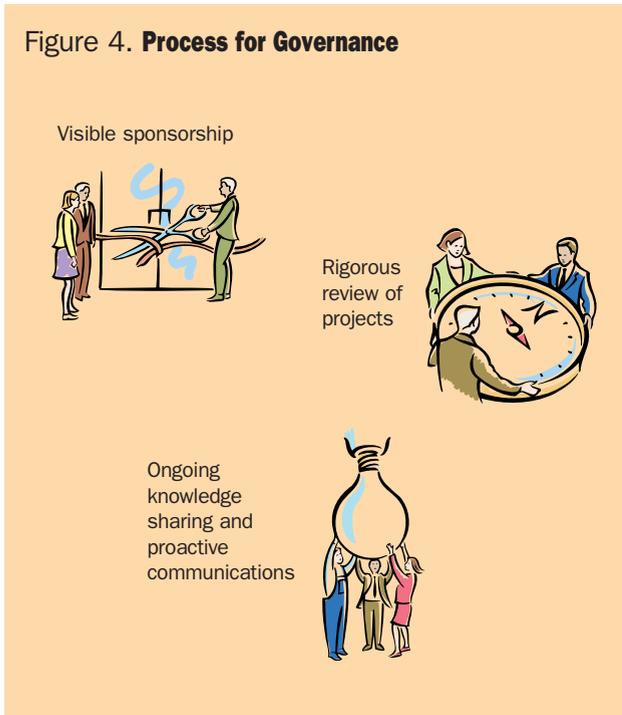
Six Sigma business improvement teams use an action learning framework to build their capability and execute the project (see Figure 3). Executives select appropriate BB and Green Belt (GB) team members based on functional expertise and provide appropriate resources.

Our action learning framework methodology combines structured education with real-time project work and coaching. This approach quickly bridges candidates from learning to doing. BB and GB candidates take an assigned business improvement project to their training. Throughout the training and project work, they are learning problem solving, project management, process optimization and statistical skills while applying them to the business problem at hand.

Outside the classroom, the candidates and project teams receive expert support from coaches on a just-in-time basis. Ongoing reviews with the project Champions also ensure the projects are progressing according to their timeline and milestones.

Motorola recognizes change is best accomplished in sprints rather than marathons, so aggressive clock management is key to driving projects toward the desired results in time to make a difference. Finally, a campaign management approach helps integrate the

Figure 4. **Process for Governance**



various project team efforts so the cumulative impact on the organization is, in fact, accelerated.

Step 4—Govern

Finally, the second generation Motorola Six Sigma methodology includes a process for governance (see Figure 4).

Leaders actively and visibly sponsor the key improvement projects required to execute the strategy. They rigorously review projects in the context of process metrics and business outcome goals.

Executive process owners look at overall organizational dashboards, their own process metrics and the status of improvement projects chartered to make improvements and ensure the overall business system is functioning as desired.

The final governance step is for leaders to actively share best practices and knowledge about improvements with other parts of the organization that can benefit.

What's next

What will the next generation of Six Sigma look like at the place where it was born? Motorola is an organization with a history of embracing renewal and continuous learning. Those traits have served us well as we

apply them to our Six Sigma business improvement efforts.

During the last 15 years, we have learned a great deal about what works and what doesn't work in our Six Sigma efforts. We have moved from counting defects in our product manufacturing to managing variation and systematically improving all our processes. Most important, we have moved from Six Sigma as a tool for improving product quality to Six Sigma as an overall business improvement methodology.

The new Six Sigma combines the power of good business application of statistics with the critical elements of effective business strategy. It uses an overall business improvement framework to improve the organization's ability to realize its strategic objectives.

This year and beyond, Six Sigma will be Motorola's tool of choice for driving bottom-line improvement across the organization. In this context, Six Sigma projects are carefully chartered to ensure their selection is based on their direct and near term impact on important scorecard objectives and metrics.

In recognition of the power of customer focus, process analysis and fact based decision making, our business leaders are expected to embrace the Six Sigma methodology. Special efforts are underway to ensure a high percentage of Motorola's leaders are qualified GBs and the percentage of qualified BBs and BB candidates is up significantly.

More of our Six Sigma efforts are—and will continue to be—focused on product design that enhances the overall customer experience and on software quality as the key driver of long-term performance and reliability.

In addition, more of our projects focus on driving improvement across the Motorola value chain. Six Sigma projects teams that increasingly involve key customers, suppliers and other business partners are the norm, rather than the exception.

The Six Sigma improvement methodology Bob Galvin sponsored 15 years ago continues to grow robustly, supporting Motorola's vision for its customers and shareholders.

ACKNOWLEDGMENT

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