

Applying Six Sigma to Six Sigma

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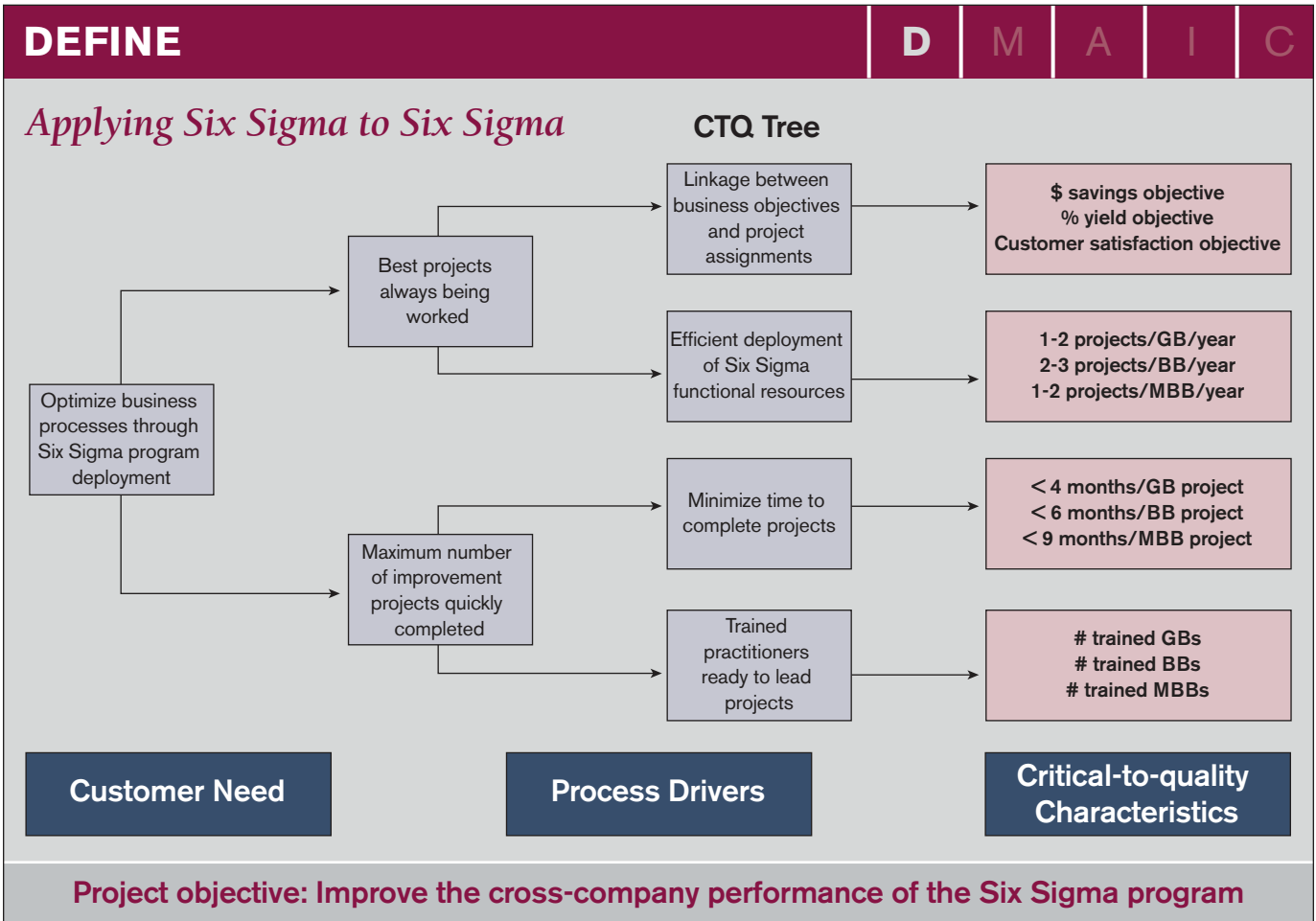
BY BRYCE CURRIE AND HOLLY DUCKWORTH

TRW Automotive is one of the world's largest automotive suppliers, producing braking, steering and suspension systems, and occupant safety systems in nearly 200 locations on four continents. After introducing Lean in manufacturing, the company deployed Six Sigma in 2001, and applies the methodology in both manufacturing and business processes. In general, as Six Sigma deployments become more mature, there is a danger of stagnating. To counter apparent suboptimization of Six Sigma at TRW, in 2007 the vice president of global quality, program management and Business Excellence challenged his group to examine itself. Through a DMAIC project, the company used Six Sigma to advance its Six Sigma program in order to meet changing business needs.

The Final Tollgate features a Six Sigma project as it would be presented to a panel of company executives at the final project review. The objectives of such a presentation are to communicate significant results of the project and share high-

lights of how results were achieved. The slides are the project leader's visual presentation and the accompanying text is the verbal presentation. It is assumed that the audience has a basic understanding of Six Sigma.

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Define

Six years into TRW’s Six Sigma deployment, a team focused a DMAIC project to determine how the process improvement program could benefit from continuous process improvement. Voice-of-the-customer interviews with business leaders revealed there were inconsistencies in the strength and performance of the Six Sigma efforts across business units and sites; some businesses had redundant resources and others were lacking resources.

The problem statement was summed up as: The Six Sigma program is missing opportunities for process improvement.

The objectives of the project were to identify what the stakeholders of the Six Sigma program need, determine the gap between current and desired performance, investigate the root causes of waning performance, find solutions to those causes, and implement monitoring methods to continually adjust the program proactively to the shifts and trends of the organization’s needs.

The first task was to determine which customer was the focus of service for the Six Sigma program. Of course the primary customer was the business itself. The significant savings reaped had become an expectation for the executives and shareholders. The Champion for this project was the CEO, in demand of continued performance improvement. The process owner was the head of the enterprise process improvement program, with a focus on ensuring a sustain-

able program. The customers of consideration were the business shareholders, operating units and members of the Six Sigma function: Master Black Belts, Black Belts and Green Belts.

A critical-to-quality (CTQ) tree identified the customer need as optimizing business processes and specified the drivers by which the Six Sigma program could meet that need. The measurable CTQs included financial objectives; the number of Green Belt, Black Belt and Master Black Belt projects per year; the time to complete projects; and the number of Belts trained.

Measure

It seemed that the Measure phase would be relatively simple because data on the number of Belts, number of projects and project duration was readily available. All the CTQ metrics looked acceptable when viewed from a company-wide perspective.

Stratifying the data by business unit, however, revealed significant differences. Some business units had only Green Belts and no Black Belts. Other business units regularly conducted four Black Belt training classes per year, and others had not offered a class in three years. Some Master Black Belts were not assigned projects; other business units had no Master Black Belts at all.

TRW Automotive is a large global organization with

MEASURE

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Survey of Program Leaders (Selected Questions from Survey)

5. Please indicate your opinion about your operating unit's performance on the following Six Sigma program aspects.

People – hiring, retaining, utilizing Black Belts and Master Black Belts

Communication – thorough and technically correct use of project tracking and performance scorecard systems

Processes – leading training events, completing projects, providing Six Sigma body of knowledge (BOK) material

Organizational structure – full utilization of DMAIC, IDOV and influence skills

Leadership – Achievement of income statement and balance sheet objectives, and report card objectives

	Worst in the company	Could improve a lot	About average	Doing well	A best practice
People	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Communication	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Processes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Organizational structure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Leadership	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

6. What issues surrounding the Six Sigma program need immediate resolution in your business segment?

Directors of organizational excellence, Master Black Belts, Black Belts and directors of operations were surveyed for current-state program attitudes.

13 business units in the United States, Europe, Asia and South America. For an understanding of the current state of Six Sigma in every business unit, the Measure phase involved surveying program leaders at each unit – directors of organizational excellence, Master Black Belts, Black Belts and directors of operations.

The survey instruments were assessed for both validity and reliability. The validity of the survey was determined with a focus group of Master Black Belts from the United States and the European Union.

Face validity, that is survey questions that appear as though they will elicit the information they are intended to gain, was evaluated by the focus group. *Content validity*, which is related to whether the questions reflect the specific intended domain of the content, was analyzed by the Master Black Belts through brainstorming and affinity exercises to ensure that the survey instrument covered as many potential content topics as was valid.

The survey instrument was then tested across all Master Black Belts in the company. Test-retest reliability was assessed to determine whether the survey would yield similar results when given to the same people at different times. In addition, inter-item reliability was tested to determine whether survey items designed to measure the same aspect had minimal variability in their responses. Cronbach's alpha was calculated for inter-item reliability.

TRW Automotive, headquartered in Livonia, Mich., USA, is one of the world's largest suppliers to the automotive industry, serving virtually all major vehicle manufacturers worldwide. A leader in automotive safety systems, the company employs more than 60,000 globally at 13 operating divisions that produce products in these areas:

- Braking systems
- Steering and suspension systems
- Driver assist systems
- Commercial steering systems
- Inflatable restraint systems
- Steering wheel systems
- Seat belt systems
- Safety electronics
- Body control systems
- Engine components
- Engineered fasteners and components
- Automotive aftermarket
- Global electronics

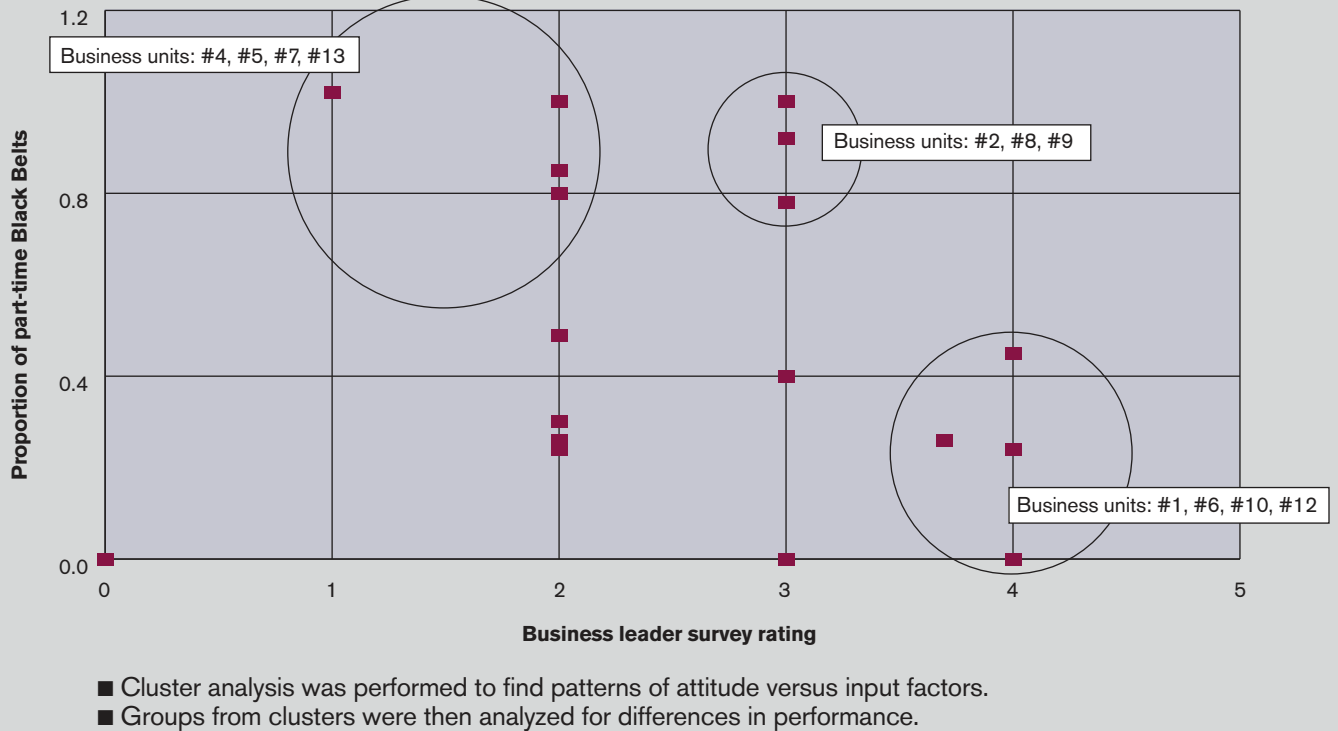
In 2001, the company deployed Six Sigma as part of its continuous process improvement program, which focuses on achieving business excellence via four strategic priorities: best quality, lowest cost, global reach and innovative technology.

ANALYZE

D M A I C

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Cluster Analysis – Organizational Structure



The survey was deployed to all of the targets and collected the CTQ measures from every unit in the company. The responses were stratified by respondent position and operating unit. This resulted in not only baseline data for the state of the program, but also attitudinal data from the leaders and practitioners across the company.

Comparisons would be made among individuals and across units in the Analyze phase.

Analyze

The primary focus in the Analyze phase was to further understand the differences among business units by comparing attitudinal data from the survey and performance data from the CTQ characteristics. Primary questions included:

- How different are the different business units?

“We wanted to understand if poorly performing business units knew they were performing poorly.”

- Is there any correlation between attitude and performance?
- What are the causal factors of performance that is below optimum?
- What are the best practices of the performing business units?
- What is working now that was not considered in the original deployment?

Regression studies were done to determine how various factors affected program performance outcomes. The factors were things related to people, communication, processes, organizational structure and leadership practices. For example, regression of number of Master Black Belts (a people practice factor) to total annual savings within a business unit was studied. The proportion of part-time Black Belts (an organizational structure factor) was regressed to the number of projects completed. The use of intra-project management tools, such as project management software, (a processes practice factor) was regressed to time to complete a project. Causal factors for outcomes were the key data points sought.

Next, we turned our attention to the comparison of attitudinal data from the survey results. For example, we wanted to understand if poorly performing business units even knew they were performing poorly. If business units knew they were one of the best performing, how had they intentionally altered their Six Sigma deployment? Was there any connec-

IMPROVE

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Paired Choice Matrix – Solution Selection for Communication

Communication Solution Comparison	ID	Count ← (From Below)	Count ↑ (From Below)	Total Score
Deploy VP podcast	A	3		3
Global event calendar	B	3	1	4
Improve knowledge management system	C	2	1	3
Improve Lean BOK inclusion	D	2	2	4
More detailed reporting to VP	E	0	0	0
Deploy report card for individual sites	F		1	1

52 improvement actions were identified: 19 people, 10 communication, 9 processes, 8 organizational structure and 6 leadership. Paired-choice matrices were used to prioritize actions in each category.

Compare	B	C	D	E	F	Count ←
A	↑	←	↑	←	←	3
B		↑	←	←	←	3
C			↑	←	←	2
D				←	←	2
E					↑	0
Count ↑	1	1	2	0	1	

When comparing “global event calendar” (B) and “deploy VP podcast” (A), B is preferred.

“Deploy VP podcast” (A) is preferred in 3 out of 5 paired comparisons.

tion between self-assessment on program structure and actions taken to enhance the program? Had the successful business units organically altered their program to better meet the needs of their business? Had the poorly performing business units allowed their program to become stale and rigid in the face of changing business conditions?

To answer these questions, cluster analyses were performed looking for patterns of alignment between better performers and worse performers, as well as between attitudes and characteristics relating to program performance.

The graph in the Analyze slide illustrates a cluster analysis on the factor of leadership opinion on the program organizational structure in each business unit and the proportion of part-time Black Belts in that unit. It shows that the business unit program leaders who thought they were the best clustered in the lower proportion of part-time Black Belts; vice versa, many of the leaders who thought their business unit was performing poorly had a higher proportion of part-time Black Belts. This tells us that, yes, there are clusters of attitude about organizational structure and the proportion of part-time Black Belts.

The next question: Does this trend in attitude and organizational structure lead to differences in performance? If business unit No. 7 (worse attitude, higher proportion) and business unit No. 12 (better attitude, lower proportion) achieved the same savings, the same number of projects and

“Each of the actions was designed to close the gap of differences...and to continue to embed Six Sigma into the culture.”

took the same time to complete projects, we could conclude that the perception of part-time Black Belts as “bad” needed to be altered.

Improve

After considerable analysis comparing attitudes, practices and performance, the team identified a total of 52 improvement actions – 19 related to people, 10 to communication, nine to processes, eight to organizational structure, and six to leadership. For each category, a paired-choice matrix was used to prioritize the actions.

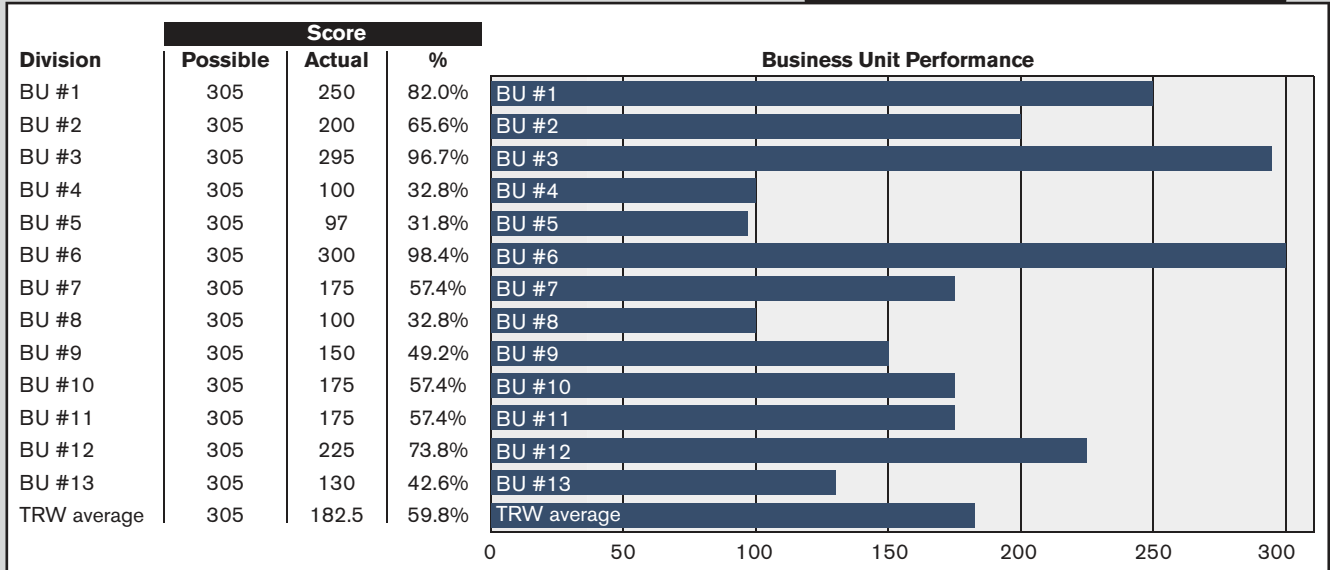
The improvement actions included: a shift in the use of Six Sigma beyond monetary savings, a better synergy between Lean and Six Sigma, training on and deployment of more innovative tools such as process simulation, and an

CONTROL

D M A I C

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Six Sigma Report Card



Results

- Monitoring method developed to track business unit performance and identify underperforming business units.
- Between-and-within-business unit comparisons on scores can be made.

increase of project leader skills through external certification. Each of the actions was designed to close the gap of differences among business units, to further engage each business leader in the program, and to continue to embed Six Sigma into the culture of the organization.

These improvement actions were difficult for some business units and easy for others. The disparity between businesses had to be addressed.

For example, one of the improvement actions was “improve training equanimity.” Those businesses not offering up Black Belts and Master Black Belts to conduct training were now required to contribute. In some cases this meant identifying, placing, training and preparing Black Belts for this “new” training responsibility. A certain allocation of time for Black Belts in each business unit had to be removed from the available time for projects and focused on conducting training. This then led to Black Belts who heretofore were consumed with classroom responsibilities now having time to complete projects. Even though the new training equanimity necessitates significant shifts within some business units, the whole company benefits.

Control

With TRW’s Six Sigma program still saving the company multiple millions of dollars annually eight years after the initial deployment, this project was not aimed at salvaging the pro-

gram from disaster. Rather, it was a recognition of the need for the program to use its own continuous process improvement methods to continually improve itself.

The key learning point was the variation among the company’s business units. Therefore, the Control phase involved a monitoring method to serve the purpose of a Six Sigma report card on how each business unit was performing on the critical factors found in the Analyze phase.

The Control slide shows a sample of the business unit by business unit report card. Each unit now submits a monthly report with a cumulative score that shows how it is doing on 11 factors. Comparisons of x-factors, not just Y-performance, are regularly reported to the organization and leadership. The Six Sigma program deployment leader can be proactive to affect the people, communication, processes, organizational structure and leadership practices within a business unit, even when the overall program objectives are being met, or exceeded. Transparency and monitoring of individual business units has been established. ♦

Bryce Currie is vice president of global quality, program management and Business Excellence at TRW Automotive. Holly Duckworth is a certified Master Black Belt and director of Six Sigma at Kaiser Aluminum. She is also a member of the iSixSigma Editorial Advisory Board.