General Motors Technical Problem-Solving Group Drives Excellence

by Megan Schmidt

At a Glance . . .

- The Red X team at General Motors was reduced by 78 percent after the company restructured in 2009.
- The team turned to lean and the Red X approaches they use to solve vehicle performance issues to increase their output of completed projects by making the problem-solving process more efficient.
- The team's success paved the way for additional projects, which contributed toward a 50 percent reduction in GM's 12-months-in-service warranty.
- The team earned finalist honors in the 2012 ASQ International Team Excellence Award competition.

Before General Motors (GM) entered bankruptcy court protection and underwent significant restructuring in 2009, the company employed 150 full-time Red X Masters working in its Technical Problem Solving Group dedicated to vehicle performance investigations. Post-restructuring, there were 32 Red X Masters left and an organization that was ready to get back on its bearings. Instead of allowing less manpower to become a roadblock, the team became determined to increase its output of completed projects and strengthen its role in making every GM vehicle better than the last one.

The Red X team embarked on a journey to adapt to GM's new organizational structure, improve its performance, and find a way to show the organization how its efforts directly reach customers.

About General Motors

Founded in 1908, GM is an American multinational automotive corporation headquartered in Detroit, MI. In 2011, it was the world's largest automaker by vehicle sales. GM employs 202,000 people and does business in 157 countries. GM has production facilities in 31 countries, and sells and services these vehicles through the brands and divisions of Buick, Cadillac, Chevrolet, GMC, Opel, Vauxhall, and Holden.

In 2009, GM undertook operational restructuring to address past failures, improve its overall cost structure, and allow the company to move toward profitability. The new General Motors Co. emerged in July 2009, and the company returned to profitability in 2011.

Red X Problem Solving

Red X strategies are based on the philosophies developed by Dorian Shainin and supported by Shainin, LLC. GM has a 20-year association with the organization and uses Red X as a technical problem-solving tool, primarily after a vehicle is launched, to understand vehicle performance issues. Red X emphasizes that most issues can be corrected by finding the root cause and controlling it.

GM employs 32 Red X Masters dedicated to solving customer concerns.

GM offers Red X certification in four levels: Red X Apprentice, Red X Journeyman, Red X Master, and Red X Teaching Master. Red X Masters possess advanced technical problem-solving skills in manufacturing situations and have demonstrated the ability to develop journeymen. Less than 1 percent of GM personnel have achieved Red X Master certification.

Revving Up for Improvement

The General Motors-Global Manufacturing System (GM-GMS) is rooted in lean methodology and structured around five principles—people involvement, built-in quality, standardization, short lead time, and continuous improvement.

The Red X team recognized an opportunity to align the Technical Problem Solving Group's goals with those of the GM-GMS and expand its role within the GM quality organization. To achieve this, the team would need to address a number of impediments, which included:

- The Red X team was seen as a last-chance, code-red task force.
- The team was not effectively containing problems and was not driving permanent corrective action through the organization. It also needed to shift its focus from exclusively long-term corrective actions to generating effective short-term solutions based on the latest knowledge to quickly contain issues reported by customers.
- The problem-solving process did not have metrics assigned, and steps the team took to resolve vehicle performance issues were not documented or standardized.
- Without a formal business plan in place, the goals or objectives of the group were neither documented nor transparent to the rest of the organization.

The Problem With the Problem-solving Process

Initially, the team was unable to determine where to focus its improvement efforts because process steps were not defined and metrics to track performance did not exist.

Using a value stream map, the team broke the problem-solving process down into individual steps. The value stream map, shown in Figure 1, helped them understand inputs, outputs, and identify stakeholders.

Red X problem-solving steps the team identified are as follows:

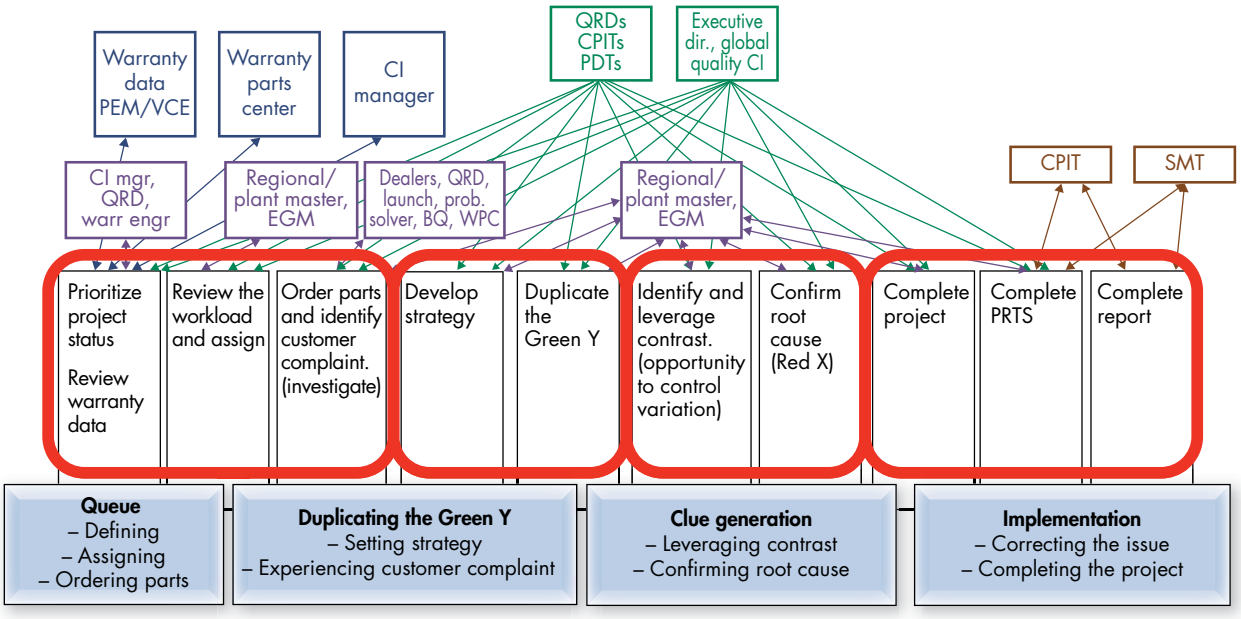
Queue – The staging area for projects needing support from the Red X team. In this step, the problem solver defines the project, prioritizes his/her workload, and orders warranty parts needed.

Duplicating the Green Y – An experimental step where the problem solver re-creates the issue the customer experienced.

Clue Generation – The problem solver utilizes his/her Red X training to converge down to the root cause of the problem.

Implementation – The problem solver applies corrective actions and completes the project.

***Figure 1**—Value stream map*



Meaningful Metrics

Value stream mapping spotlighted areas where improvements were needed, but the team knew an actual measurement system would need to be developed to fully grasp performance.

The team discovered an accessible and readily available system known internally as the Problem Resolution Tracking System (PRTS), which is used organization-wide to document all issues during a vehicle's life cycle. The team worked with the PRTS group to develop a Red X application to begin tracking projects and generate the data needed to complete its performance analysis.

Examples of key metrics the team created include:

- Days in step – The average number of days for projects that have completed a problem-solving step during the month. It also provides real-time tracking of projects as they move through the system.
- Step performance trend – The average performance trend of projects based on start date. These data show performance improvements over time.
- Vehicle identification number (VIN) breakpoints – A VIN breakpoint represents the first vehicle that is built with the latest knowledge learned from a Red X project. Tracking the number of VIN breakpoints represents the output of the Technical Problem Solving Group, showing the impact of actionable information that has been generated to protect external customers.

The Red X application outputted weekly reports and monthly bar charts to show trends in problem resolution time. With actual performance data to analyze, the team determined it should focus its improvement efforts on reducing the time to complete process steps and projects overall.

Data-driven Decision Making

The team utilized its layered audit system to acquire internal customer feedback to define an acceptable amount of time to solve a problem. The team also examined its Red X application data to observe how long the "best of the best" (BOB) problem solvers took to complete projects compared to the "worst of the worst" (WOW).

Using the information collected from the Red X application, and knowing that the traditional engineering model of making design changes to correct issues requires an average of 200 days, the team determined that the "customer enthusiasm limit" to solve a problem is around 60 days. Red X application data showed that the team had been performing outside this parameter, as they were "duplicating the Green Y" in 70 days on average, and completing their clue generation step in 59 days on average.

To meet the customer enthusiasm limit, the team assigned goals for each problem-solving step: 25 days for duplicating the Green Y, 25 days for clue generation, and 10 days for implementation.

X Marks the Problem

The team used Red X methodology and tools from the Red X arsenal to find the root cause, or the "Red X," bogging down the problem-solving process. One of the major components of Red X methodology is the BOB and WOW contrast, which are Red X terms that indicate opposite tails of a normal distribution.

Problem and project definition trees, shown in Figure 2, displayed data collected from the measurement system and were used to communicate project information to management in a convergent format. These tools also helped the team prioritize final improvement opportunities. The problem definition tree showed that the focus should be the duplicating the Green Y step, as it would have

***Figure 2**—Project and problem definition trees*

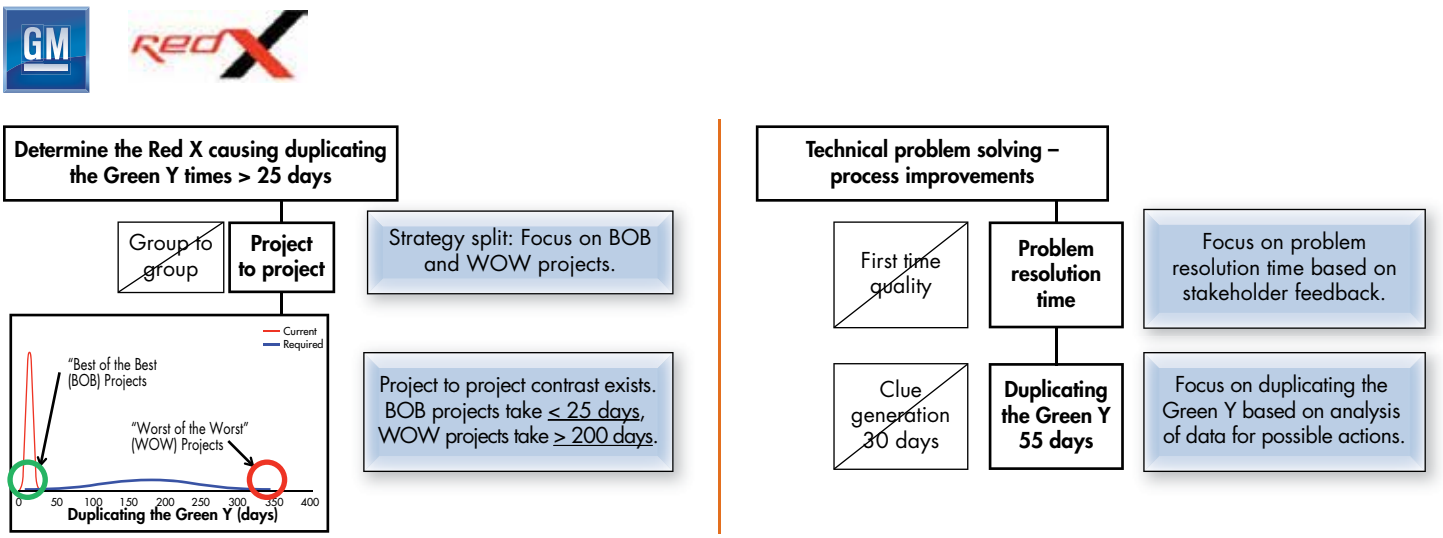


Figure 3—Strategy diagram

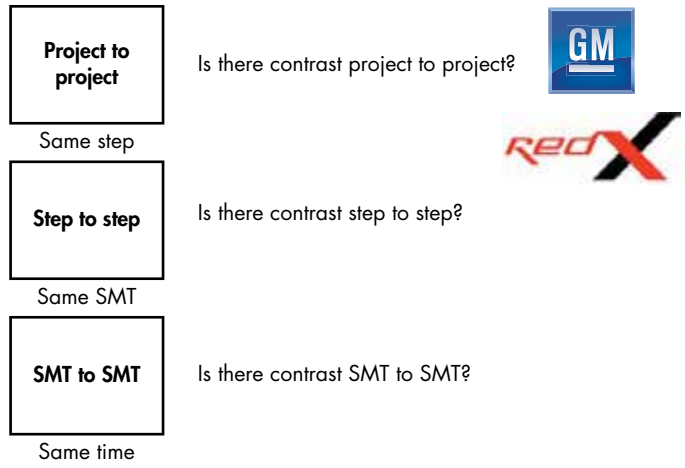
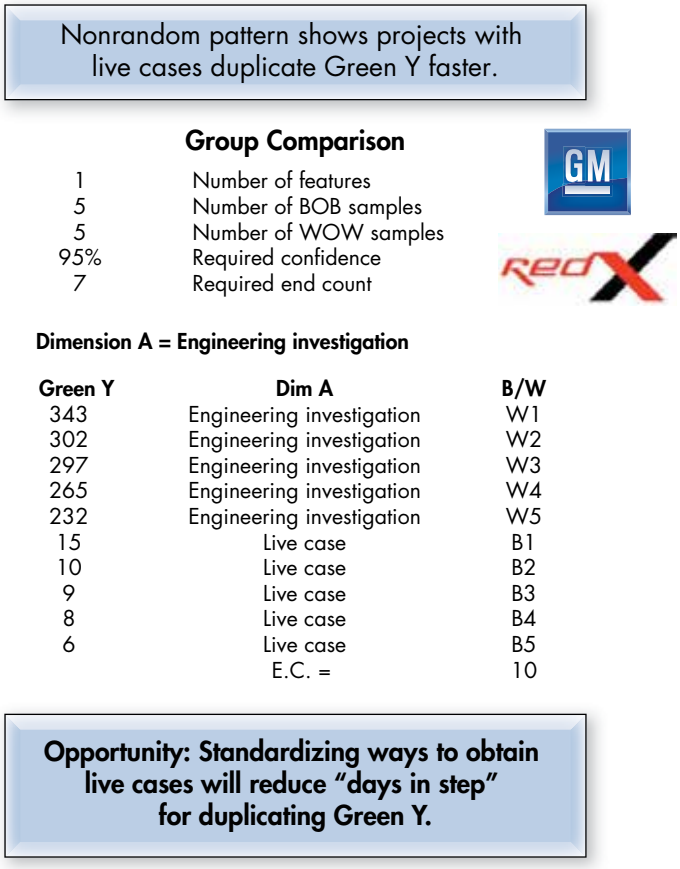


Figure 4—Group comparison



the largest impact on improving the overall problem resolution time. A project definition tree showed that the team should use a project-to-project approach to leverage contrast.

In an effort to understand why some problem solvers performed better than others, the team used a strategy diagram, depicted in Figure 3, to analyze time in step, step-to-step time, and variance between system management teams. The analysis revealed BOB and WOW projects were alike in every way except for the Green Y difference. The team dug deeper into data and found that BOB projects completed the step in fewer than 25 days, while WOW projects took more than 200 days.

Next, the team used a group comparison tool, shown in Figure 4, to compare five BOB and five WOW projects to determine if there was a nonrandom pattern in the data. The team found there was a potential correlation to the engineering investigation process, which is initiated through bulletins as soon as a dealership learns a customer is experiencing a technical issue. Problem solvers with access to these live cases duplicated the Green Y faster.

The team concluded that supplying problem solvers with creative strategies to find live cases would speed up the duplicating the Green Y step.

Standardizing Toward Excellence

Problem solvers had their own ways of performing the tasks required to resolve an issue. This variation led to some problem solvers being more effective in certain aspects of the process than others. Standard operating procedures were created based on the value stream map to define each step of the problem-solving process and the stakeholders involved.

BOB problem solvers were asked to document how they complete their work and create task instruction sheets for all critical tasks a Red X team member would encounter during a project.

Also developed were standard task sheets, which defined the responsibilities for managers, leads, problem solvers, and new employees. This eliminated confusion about who was supporting whom and who was responsible for what.

Seeing the Big Picture

Using data captured from the Red X application, the Technical Problem Solving Group created a business plan deployment board, similar to one used by GM at the organizational level, to track goals. The board has helped reinforce the department's focus on process and performance.

The team also created a process flow board, which is a visual representation of projects flowing through the system. Displaying Red X projects helped the team locate waste in the

system and it provided an additional platform to standardize work. It also has helped the team to quickly spot project lags and allocate resources accordingly.

Keeping Stakeholders at the Center

Internal stakeholders were involved through all phases of the project. The team studied metrics and goals of other GM groups and tried to understand how they could contribute to the success of those groups. Stakeholders were also asked to complete surveys and audits to ensure any changes that were implemented would be mutually beneficial.

Without direct access to external stakeholders, the team obtained voice of the customer data from internal stakeholders and made logical inferences. The team felt increased speed and efficiency of the problem-solving process would allow for faster information transmission to service technicians, which would improve the customer experience and better their ability to service customers' vehicles.

PDCA

To validate the effectiveness of the team's final improvement action of standardized work activities, the team used the iterative steps of Plan Do Check Act (PDCA):

- PLAN – Developed goals for the responsiveness and quality sections of business plan deployment board. These plans formed the basis of metrics and actions and relate specifically to standardized work.
- DO – Executed the standardized work through the typical problem-solving steps.
- CHECK – Measured the system's performance.
- ACT – Documented action items for improvement based on results.

This approach facilitated continuous improvement as the team quickly reacted when refinements to documents supporting standardized work were needed.

The team also monitored performance by holding daily meetings to review project statuses, as well as weekly meetings to focus on metrics for duplicating the Green Y. Overall, data trends validated that the final improvements were successful.

Results

The Technical Problem Solving Group now has a way to show the company that bringing work to the group results in actionable information and vehicle improvement. In 2010, the Technical Problem Solving Group overachieved its goal of 144 VIN breakpoints, reaching 166. The next year, the team's goal was increased from 300 to 400 in quarter one because of their stellar performance. As shown in Figure 5, the team achieved its increased goal of 400 VIN breakpoints in 2011.

Prior to project initiation the average time for duplicating the Green Y time was 70 days and clue generation was 59 days. Through the implementation of the standardized work procedures and other improvements, duplicating the Green Y was reduced to 21 days and clue generation was reduced to 19 days, as illustrated in Figure 6. The team increased its throughput of projects by 60 percent, as shown by the number of VIN breakpoints generated in 2011.

***Figure 5**—Vehicle identification number (VIN) breakpoints*

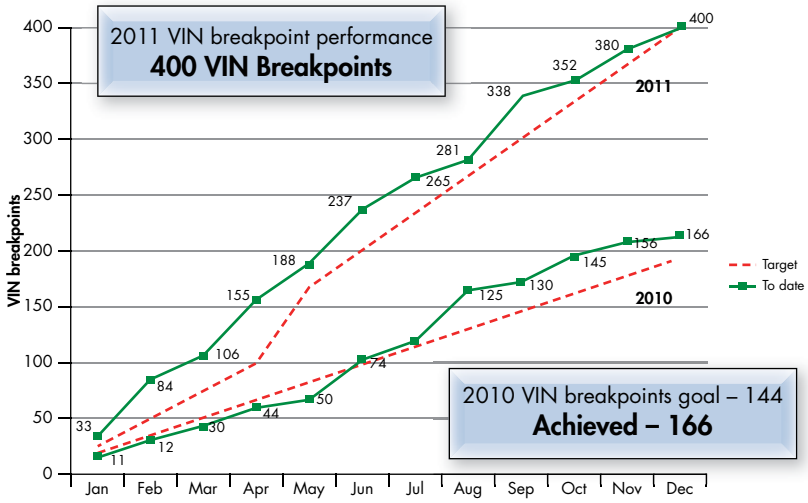
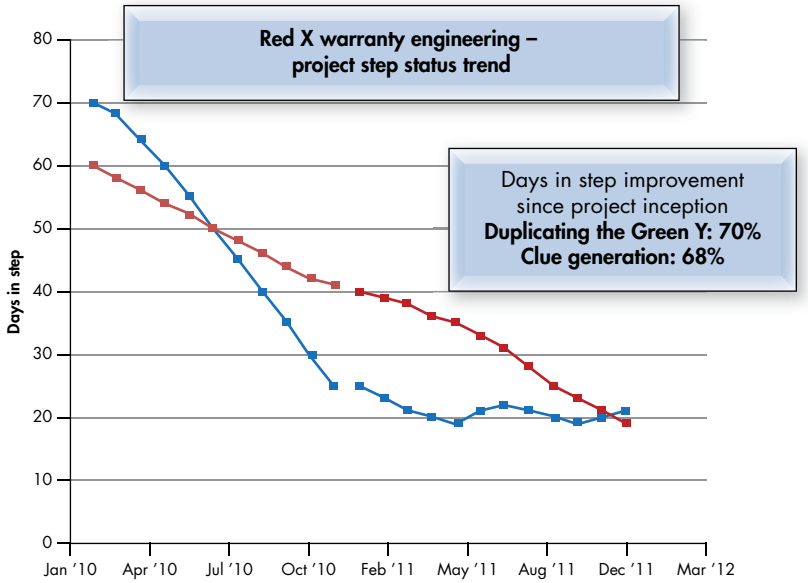


***Figure 6**—Completing targeted process steps faster*



As the amount of actionable information from the group increased, the team has garnished direct access to vehicle program teams, the engineering organization, and the quality organization. This exposure has generated additional projects for the team to work on. Through this additional project work, the team has impacted GM's overall warranty performance. Figure 7 shows GM reduced its 12-months-in-service warranty by 50 percent since 2009.

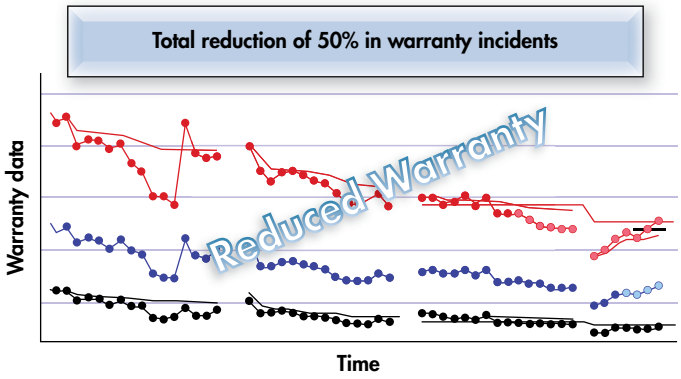
Transformed Role in Organization

Honing the problem-solving process has had a ripple effect. The Technical Problem Solving Group was requested to conduct more Red X training classes to bring the GM engineering organization onboard with the approach.

Perhaps the greatest benefit of this project was its impact on engagement within the department. In the most recent GM Workplace of Choice survey the Technical Problem Solving Group scored the highest satisfaction scores of the GM quality-related groups and above the overall GM company-wide average in all categories.

The Red X team shared its journey with members of the international community as finalists of the 2012 ASQ International Team Excellence Award competition.

Figure 7—*GM warranty performance from 2009 to 2012*



Lesson Learned

From the beginning, the team feared that standardized work activities would stifle what made Red X successful—creative strategic thinking. They believed too much standardization caused processes to be lost in the dogma of tactics. Because standardized work procedures may have required problem solvers to operate differently than they had in the past, problem solvers were concerned they would be sacrificing quality for speed. In the end, the team discovered that standardizing the inputs to the problem solver actually increased the creative process and allowed them to do what they do best—provide every customer with a vehicle built from the latest knowledge.

For More Information

- Contact Bill Merrill, manager of the GM North America Technical Problem Solving Group at bill.1.merrill@gm.com.
- Visit the General Motors website at www.gm.com.
- Learn how to apply measuring tools to your program and monitor its performance at asq.org/learn-about-quality/using-data.html.
- Read more about process management at asq.org/knowledge-center/process-management/index.html.

About the Author

Megan Schmidt is an ASQ staff writer.