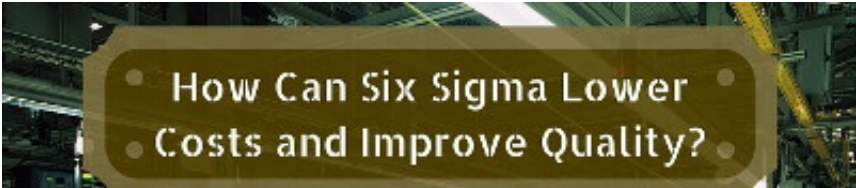


HOW CAN SIX SIGMA LOWER COSTS AND IMPROVE QUALITY?

Manufacturing and QC blog

By Chao Wang 16 Nov 2015

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• How Can Six Sigma Lower
• Costs and Improve Quality? •

Have you ever bought a piece of furniture and found during assembly that one of the screws didn't quite fit because the hole was drilled at an



angle?

This seems like a very simple mistake during the manufacturing process. You may ask, why was such a simple mistake made in mass production? Well, this could be due

to a lack of Six Sigma techniques in place at the factory to reduce variance in their processes.

We've discussed **lean manufacturing** and the **5S method**. Let's look at a real-life, practical application of a Six Sigma methodology. You'll learn how one company was able to improve a process and exceed their target goals significantly.

Six Sigma origins

Six Sigma is a set of practices and techniques for process improvement. Six Sigma improves the quality of the final products by finding and removing the causes of errors and reducing variance in manufacturing processes. "Sigma" refers to the rating a manufacturing process receives based on defect free production. "Six" Sigma derives from its goal, which is to enable processes to produce results with no more than 3.4 defects per million.

The Six Sigma concept was first introduced by an engineer at Motorola in 1986. Motorola later attributed savings of **more than \$17 billion** as a result of implementing Six Sigma in their production.

Why is Six Sigma important?

Cost reduction is important, but how does Six Sigma help companies do that? Well, imagine you are buying something plastic, like a small toy. Material is melted and then fed into the injection machine. The melted plastic goes into a mold and solidifies to form the toy.

Can you guess what happens if there is variability in the time that you open the mold? If you open it too early or too late, the product may deform in different ways due to the drastic change in temperature. So both timing and temperature in this case are extremely important in manufacturing a product that satisfies the customer.

Depending on the product, there can



be anywhere between tens and hundreds of processes. Each process may have its own key points to control in order to reduce variability.



This is why Six Sigma is so important and why qualified inspection and process auditing are often strongly recommended (see [Process Auditing vs. QC Inspection](#)). People can easily be stuck in a rut. And often it takes an outside perspective to point out those areas that may cause issues.

How Ford used Six Sigma to lower costs and improve quality

Six Sigma projects carried out in an organization follow a defined sequence of steps and have specific targets. In 2009 [Ford Motor Company](#) found that basecoat consumption for two models at their plant in Saarlouis, Germany was 3.74 kg/unit in 2007, while current consumption was higher at 4.18 kg/unit. With this discovery, Ford saw an opportunity to improve by applying Six Sigma principles.

"Six Sigma projects carried out in an organization follow a defined sequence of steps and have specific targets."

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They used the “define, measure, analyze, improve, and control” (DMAIC) approach to find a solution.

Define

The “define” stage of Six Sigma aims to identify the key stakeholders involved and design goals that address the needs of those stakeholders. When defining stakeholders – those people by the inefficiency – Ford arrived at three groups, consisting of end customers, process owners, paint



shop workers and others.

They then set specific and quantitative goals to address the problem:

1. **Reduce costs** – lower production costs by \$1.5 million annually by lowering the consumption of paint in manufacturing.
2. **Improve customer satisfaction** – meet customer needs better with a reduction of 127.000 ppm

(defective parts per million).

3. **Reduce environmental impact** – lower consumption of certain paint compounds to achieve a 50,000-kg reduction in **Volatile Organic Compounds (VOCs)**.

Measure

The “measure” step in Six Sigma measures current processes which relate to your problem or inefficiency. This part is crucial to collecting data revealing root causes that can be addressed.

“The “measure” step in Six Sigma measures current processes which relate to your problem or inefficiency.”

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In Ford’s case, they measured the following critical factors:

1. Daily basecoat consumption
2. Paint coat thickness
3. Paint consumption per robot (for automated paint stations)
4. Consumption per human painter (for manual paint stations)
5. First-time through rate versus consumption; and
6. Technical problems with application equipment

Analyze

The “analyze” step aims to determine the root cause(s) related to the problem you want to address, based on relevant data you’ve gathered. Ford’s team analyzed the data collected when measuring the six factors above and pinpointed one major contributing factor to the problem.

There were two likely root causes found for excess paint consumption during production as

follows:

1. Higher consumption in robots applying paint to the lift gate.
2. A fault in the solvent recovery valve of the application equipment. This meant that paint that should have been applied was leaking into the sprayers' recovery tank.

Improve

“Improve” is a step which focuses on finding solutions to or improvement actions to eliminate the root causes found during the previous step. The team at Ford found they could replace the automated process of painting lift gates with manual application to solve the consumption issue there. They also found four potential solutions for improvement that addressed all of their goals:

1. Replace plastic valves with more durable stainless steel valves
2. Create an automated system to check valve recovery
3. Manually check valves weekly; and
4. Eliminate the solvent recovery process

Goal	Target	Result
Lower costs	\$1.5 million annually	\$2 million annually
Improve customer satisfaction	127.000 ppm reduction	129.000 ppm reduction
Reduce environmental impact	Lower VOCs by 50.000 kg annually	Lowered VOCs by 70.000 kg annually

Following test trials, the team found that replacing the plastic valves and creating the automated valve check system were the two solutions that best met their goals. When the changes were implemented, the plant actually saw improvement *beyond* what they set as targets in the goals they set.

Control

The last step in the DMAIC method of Six Sigma is “control”. This step is critical to maintaining the improvements realized when implementing measured to address the root causes of a problem.

Ford continued to use their new automated system to check valve recovery. They also included this in criteria for ISO 9001 **quality systems management audits** at the plant. Routine audits help to ensure paint consumption is continuously managed and within specifications.



Conclusion



When the important variables are controlled within the processes, your chance of getting closer to the “perfect” product will be much higher. Six Sigma processes allow you to be more confident in the quality of your product. This is especially important when a company’s public image is so important to the consumer.

In Ford’s example, the plant was able to reduce costs related to waste, reduce the defect rate and reduce their environment impact. They accomplished all of this by putting a Six Sigma methodology to practice.

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Fred Dyson 11/22/2015, 3:55:11 AM

Why do you think so many senior managers within business today resist implementing 6 Sigma or similar processes/programmes.

← **REPLY TO FRED DYSON**

John Niggli 11/26/2015, 1:44:19 AM

Hi Fred,

You raise an important question. Six Sigma is somewhat controversial. Even the legendary quality consultant Joseph M. Juran, who introduced quality management techniques to Japan in the 1950's, had criticisms of Six Sigma and believed it was not especially innovative.

I suspect the main reason we see resistance from senior managers today regarding implementing Six Sigma or a similar Lean practice is that Six Sigma often requires a "paradigm shift", a major change in the mentality of middle managers and their subordinates. Progress with Six Sigma requires flexibility and a willingness to change the processes that employees and managers have grown accustomed to for years or tens of years in some cases. This is also part of the reason so many organizations that attempt to implement Six Sigma ultimately fail. They might succeed in the short term but aren't able to follow through. And it's the following through that is often the most difficult part to get everyone on board with.

← **REPLY TO JOHN NIGGLI**

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Chao Wang 

Chao Wang was born in Xi'an, China but grew up in Boston, Massachusetts. He has worked in factories in China and Japan, and has a very good handle of what a good factory should look like. He worked as a Client Manager at InTouch from October 2013 to September 2016.

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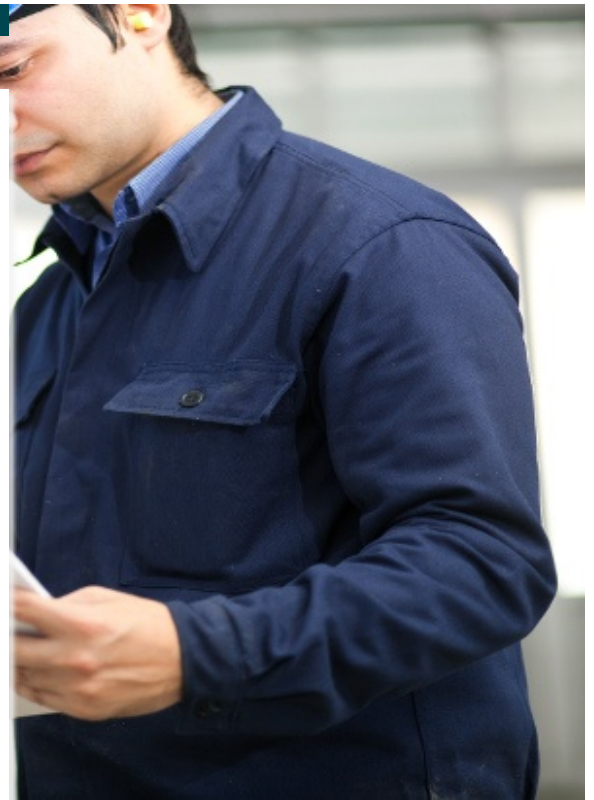
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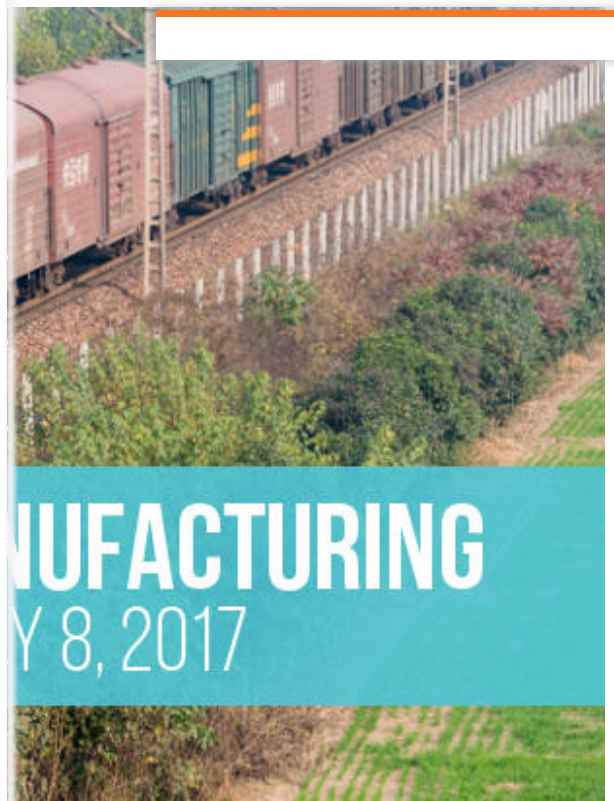
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