

Increase Profits Using Process Management Tools

Advantage Series White Paper

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Tough times call for bold actions. The advanced materials manufacturing sector is going through a challenging period. Take a hard look at your business. Are your customers complaining about defective products or materials that don't meet specs? Is the cost of poor quality (scrap, rework, high inventories) cutting into your bottom line? Are your competitors gaining market share with better materials or faster delivery?

Gain a Competitive Edge

Implementing a process management approach will allow you to:

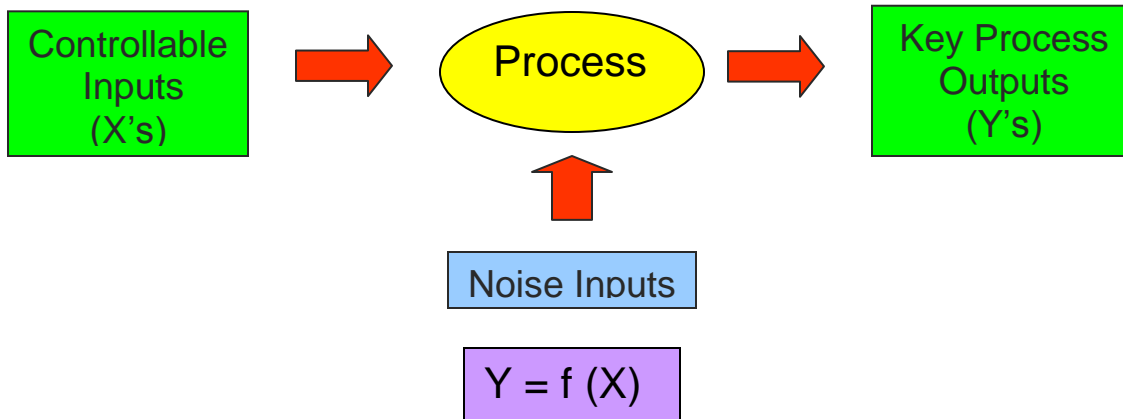
- Reduce scrap and rework allowing you to provide a low cost option for your customers
- Reduce inventory and eliminate costly non-value added manufacturing operations
- Deliver nearly defect-free products 100% of the time
- Provide shorter lead-times and guaranteed on-time delivery
- Enable your customers to be successful by providing the material performance they require

Competition in the marketplace is brutal. Price erosion is significant. Customers are demanding better service and are upset with unreliable products. Investors are looking for better business models and increased profitability. In order to increase profits, you must vigorously eliminate cost in your manufacturing operations and develop new high margin products that can gain market share.

Time for a gut check. Do you have the courage to commit some talented resources to reduce defects and eliminate non-value added manufacturing operations? This won't be an easy task, but the failure to act is even more painful.

The Process Management Solution

Process management tools provide solutions to complex problems. All work activities are a process whether they are in manufacturing or in the office. The process can be graphically described using a technique called a process map or flow diagram. For each individual process step or for the overall process, the key input and output variables are identified:



The controllable key process inputs are termed the X's and the key process outputs are termed the Y's. The outputs (Y's) are a function of the X's. In mathematical terms, $Y = f(X)$. The process management approach is to identify and improve key Y's. The process improvement roadmap is:

1. Identify the key process outputs critical to customer satisfaction (find the key Y's)
2. Investigate how the input variables (the X's) impact the critical Y's
3. Prioritize the key X's
4. Reduce variation and control the key process inputs (the X's)

For example, in the manufacturing of a printed circuit board, the final thickness may be a key output variable for a particular customer part. During the final lamination process, the key input variables might be layer thickness, the amount of resin to bond the layers together, the press heating rate, and lamination pressure. Design of Experiments (DOE's) are typically used to establish how the key input variables control or influence the key output variables.

In the printed circuit board case, the heating rate and pressure have a large influence on the final part thickness. These variables can be controlled using a standard operating procedure (SOP) such as a computer controlled lamination process that is set for a given part number. The key process variables are also measured and documented in a process log or traveler that accompanies the order.

Noise variables are defined as inputs that will have an impact on the output variables, but are very difficult or very expensive to control. An example of a noise variable would be relative humidity in the vicinity of a coating process. Moisture can affect the coating process by changing the viscosity and impact the curing rate if moisture interacts with the catalyst. To control noise variables, two approaches can be used:

1. Install expensive temperature/humidity controls to minimize the impact
2. Use Robust Design techniques to design the material/process to be insensitive to moisture, thus alleviating the need for expensive controls

Process Improvement Method

Six Sigma is a systematic process management method for improving, building, and sustaining business performance. Six Sigma uses a structured approach and toolset focused on reducing variation and delivering near defect-free products and services. The Six Sigma toolkit can be used for

a variety of applications, including manufacturing cost reductions, developing new products (Design for Six Sigma), and business process improvements.

Traditionally, Six Sigma has been used in solving manufacturing process problems. The power of Six Sigma lies in the process focus. Remember, all work is a process. Think about customer invoicing, order entry, or customer service. These are processes that have the potential to cause defects and variation for your customers. The goal of all process improvement efforts is to identify the key process outputs and then minimize variation and control the key process inputs variables.

A balanced approach addresses both customer focused projects and internal process improvement projects. To maximize the potential gains, the project portfolio should contain a balance of both short-term and long-term improvement projects.

What are the elements of a good Six Sigma project?

Good Six Sigma projects are linked to a clearly defined process and have the following four elements:

- There is a gap between current and required/desired performance in a key business process (manufacturing or transactional process). Closing the gap will have a measurable and large financial impact.
- The cause of the problem or gap is not clearly understood.
- There is not a predetermined solution or optimal improvement method readily apparent.
- The performance of the process can be measured and quantified.

The following is an example of a good Six Sigma project. Acme Widgets Inc. is the manufacturer of a really cool new toy. To keep up with tremendous market demand, Acme installed two new molding machines. The engineers found that for one part of a subassembly, a critical part dimension was changing in a random way. This caused problems at final assembly, since the parts wouldn't fit properly.

The part variation was traced back to the two new machines. There also was variability between the two new machines. Operators said that they had trouble keeping the new machines running in spec and hated to run the new equipment. Scrap from the two new machines is costing Acme \$2,000 per day. Customers are upset because Acme can't ship enough of the cool new toys and some are defective.

Analysis:

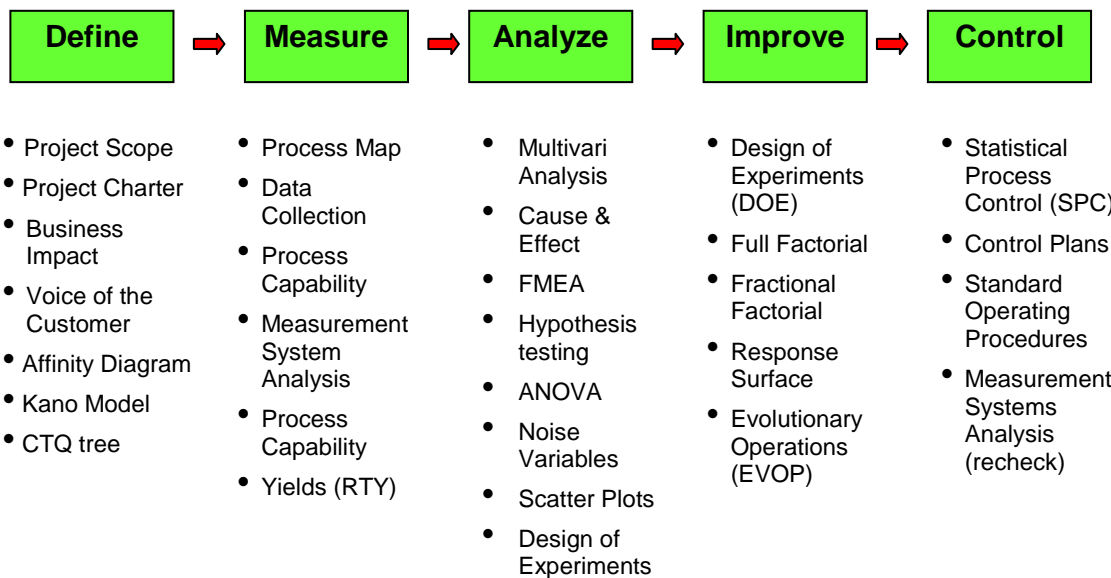
- There clearly is a defined manufacturing problem with a large financial impact.
- The root cause of the problem is not clearly understood, but early data suggests the two new machines are involved.
- There is not a readily available solution to the problem.
- The yield of the molding process can be measured and quantified.

Six Sigma Projects are led by Black Belts who are highly trained in all aspects of the DMAIC process. Green belts are project team members and have training in most of the Six Sigma tools and approaches.

Six Sigma utilizes a five step process called DMAIC:

- Define:** Select the appropriate customer-focused defect or problem. Document the business impact and the project deliverables in the project charter. Form a multidisciplinary team.
- Measure:** Develop a factual understanding of the current process and locate sources of problems. Establish “as-is” process map, measure process capability, and collect data to give a baseline of the current process.
- Analyze:** Identify potential root causes of defects or sources of variation. Investigate the causes of defects using experiments (and statistical analysis). Verify the root cause(s) of the problem.
- Improve:** Eliminate the verified root cause(s) or reduce sources of variation. The goal is to demonstrate with data that the problem is solved and leads to a measurable improvement.
- Control:** Implement methods to hold the gains such as standard operating procedures and statistical process controls (SPC).

The following diagram shows the tools used in the various phases of DMAIC:



Six Sigma was developed at Motorola and has been successfully deployed AlliedSignal (now Honeywell), General Electric, and many other companies with reports of total savings in the billions of dollars. The key to the success is top management buy-in, data-driven decision making, and a focus on achieving bottom-line results. Deployment of Six Sigma requires strong leadership and a commitment to continuous improvement from the whole organization.

Reasons for Six Sigma success include:

- Focus on customers and processes
- Achieves bottom-line results
- Clearly defined measures of success and financial returns
- Well defined project selection criteria
- Uses a disciplined project approach (DMAIC)
- Manageable project completion times (3-6 months per project)

Benefits of Six Sigma projects include:

- Increased customer satisfaction
- Improved profitability by eliminating defects (reduced cost of poor quality)
- Enhanced productivity
- Reduced cycle times
- Improved product and service offerings

Summary

With the economy in a state of uncertainty, it is time to act. Take a close look at your business and locate the problem areas and opportunities to improve. Use your internal resources or seek outside help to get the ball rolling. There are several tools available for process improvement. The Six Sigma toolkit described in this article provides a structured roadmap to eliminate defects, reduce variation and delight customers, leading to a measurable bottom line impact. Before it's too late, work hard to dramatically improve your business processes. This won't be an easy task, but the failure to act will be even more painful.

Do you have a tough continuous improvement project that just can't seem to get traction?

Contact InnoCentrix to see how we can help.

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