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Five Tools for Ensuring Quality and Reducing Costs in Manufacturing

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Iterate or die

Customers want more value from you as a supplier. They want it with shorter lead times. They want your innovation in the product, and they don't want to pay for any of it.

I often hear the declaration, "We can't reduce costs anymore!" from manufacturers (similar statements come from other businesses), even though they're players in the real world of not just competition, but also technical development.

When I worked at the Australian automaker Holden, there was a calculation done prior to the launch of the VT Commodore in 1997. The calculation showed that, according to the plant's average weekly wages, the VT Commodore was cheaper to produce than the first Holden that rolled off the assembly line in 1948.

Think about that for a moment.

With all the extra capability, features, comfort, safety, and reliability that are in the modern car, they are cheaper in relative terms than those that came before them.

I have no doubt this is still true for new cars released today.

Do you think that somewhere along the line, someone in the past also felt they had reached the end of the road in terms of reducing costs and generating refinements?

Of course they have. Yet, the improvements continue.

This article explains five key tools that should be used to help you customize and adapt your business to keep providing more value in a commercially sensible fashion for you and your shareholders.

1. DFMEA

Starting at the beginning, a design for a product is created. We'd all like to believe that we've designed the product flawlessly, but pragmatically, we know that despite our best efforts, things don't always go according to plan.

That's what testing is for, you say. Absolutely. However, there's a prior step that can save a lot of time, money, and heartache while costing nothing more than a few hours of work and maybe some lunch.

DFMEA stands for design failure mode and effects analysis. This is a “war gaming” exercise to systematically analyze the design and help us proactively improve it. What we’re looking at are three criteria:

1. How severe an impact would a failure create?
2. How often will it occur with the current design?
3. How easily can we detect the failure before it occurs?

Each of these criterion is evaluated on a score of one to 10, with 10 reserved for an absolute certainty of occurrence or catastrophic impact of failure, and one reserved for incredibly rare or insignificant impact. The three individual scores are multiplied together to produce what is known as a risk priority number (RPN) between zero and 1,000.

Potential failure modes are ranked according to the highest RPN to lowest, and we evaluate how to improve the RPN so that following a reassessment, the RPN has been reduced to an acceptable level.

The first question we’re asked when we run this as a workshop is: “What is an acceptable level?” The answer is you choose that based on the risks you’re willing to take. There are guidelines for this available, which can be customized to address local regulatory and cost impacts that must be considered, as well as the brand reputational perspective.

2. Process flowchart

After we’ve completed a first-pass DFMEA and made changes, we can then move into drafting a process-flow diagram of how the part will be produced. Very simply, we list each step in the process, in order, and identify if it is:

- Value adding
- Transporting or moving
- Inspecting or checking
- Delaying or waiting
- Deciding or reviewing

Having identified all of these steps, we can then assess what we would change (minimizing transport, for example) to reduce the costs of production, the equipment required, and the time taken to produce the product.

Once again, this is a first pass.

3. PFMEA

Using the input from the DFMEA and the process flowchart as well as the design drawings, we can then begin to use the process failure modes and effects analysis (PRMEA) tool.

We repeat the process of creating RPNs for each of the failure modes; however, this time we focus on where the process of producing the parts can fail rather than the design itself.

Again, we rank the RPNs from highest to lowest and develop solutions. We modify the process flowchart to reflect the new situation.

If we can't reduce the RPN in the PFMEA to an acceptable number by changing the process, this is a "red flag" indicating that we need to go back and try to eliminate the issue by changing the part design.

A great way to waste money in manufacturing is to try and compensate in production systems for a fundamentally lousy design. The analogy of "you can't make a silk purse out of a sow's ear" comes to mind.

Many manufacturers that say there's nowhere to go to improve profitability are still compensating for poor designs or processes with 100-percent inspection. This is an unnecessary structural cost that is built into their business and is right in front of them.

Assuming we have a revised process that is usable, we start moving into developing the detailed quality plan for the production process.

4. PCP—process control plan

The process control plan (PCP) is the detailed quality plan for the production system. This document is based on the DFMEA, the process flowchart, and the PFMEA. The PCP shows us:
• Exactly who will conduct the checks on the production process
• How he will do it
• How often it will be done
• What tools will be used
• What measurements will be recorded
• What is the allowable specification range of these measurements
• What to do if a problem is found

The PCP also explains who will "check the checker" and gives the same instructions about tools, frequency, and so forth.

This document is what appears on the production floor and is used by the operators to ensure that they are producing quality parts. The operators must be familiar with it and its contents, and be able to explain it to others.

Your internal audit system (you do have one, as I'm certain you are quality certified, aren't you?) would use this document as the basis for the audits of the shop floor production processes.

5. Work instructions

Detailed work instructions for the operator should be developed *after* a draft PCP has been established, and the process flow diagram has also reached a level of maturity.

The work instructions document should be detailed yet simple to use, so that it can be used to train new operators and refresh more

experienced people when there are changes, or when they return from leave. Work instructions should detail at least the following information:

• All of the steps required to be performed
• The safety precautions that must be taken (such as wearing personal protective equipment)
• Gauging and measuring processes
• Packing and labeling
• Quality checks required
• Cycle time required
• What to do in the event of a problem

This is a document that must be available to the operator, and she should be familiar with it and able to explain it to others.

What's the catch?

Sounds simple, doesn't it? Many businesses still don't use these tools, and it costs them. Some businesses use some of these tools, but usually it's just the job instructions. Other businesses will perform the process on a new design but do it only once.

The catch in all of this is that you need to iterate through these five processes all the way from initial design, through prototyping, pilot production, and into production and beyond.

Even once you are in production, you should review all of these processes and update the analysis at least annually, based on customer feedback from the real-world testing your product is now receiving.

Sounds like a lot of work?

You can turn this into a bureaucracy if you allow it to develop that way. Facilitators (here's where quality assurance should earn its keep) must keep the process grounded and moving forward. The cross-functional team that contributes to this work must be prevented from becoming stuck in the mud. This process is about serving clients profitably, not a paperwork nightmare of excuses that justify doing nothing.

As far as the workload goes, it's amazing what you can work through in a few hours every week if you stay focused. If you think about what happens when you have a major quality problem, the hours don't seem so onerous. Definitely the stress levels are lower. If you've had a quality recall or major customer complaint, you've performed this work already. You looked at why the design or process failed, how it slipped through your system, and redesigned some or all of this to fix the issue. These processes will get done eventually, so you may as well do them proactively and in a controlled environment, instead of reactively and expensively.

How does this reduce cost?

The fundamental start of the cost-reduction process can begin by using the process flowchart. Anything on the flowchart that isn't identified as value adding is up for interrogation as to why the company is spending money doing it.

The knee-jerk cost-reduction approach cuts things out without a solid thought process about the customer impact. Using the process flowchart, evaluating the impact of changes using the DFMEA, PFMEA, and updating the PCP and work instructions don't have to take a long time, but they can ensure that you reduce the costs without damaging your clients or incurring future costs in rework because defects begin to slip through.

Regular, in-depth reviews of the process flowchart will identify opportunities for cost reduction that usually will improve quality and reduce lead time.

Reducing transport is an example. If your product can be damaged in transport, it will. So if you can reduce the number of moves, you not only reduce the cost of moving things pointlessly, you also reduce the chances of a stray forklift tine damaging the packaging, or some other unforeseen accident wasting the quality work done so far.

Obviously you'll want to do this for new products moving forward, but applying these tools on current products is where the most immediate gains will be made. Initially, you don't have to look at every aspect of the process. Focus on where you know you have quality issues that cost (e.g., customer complaints), where you have nonvalue-added activities according to the process flowchart, or on any process that creates the need for increased levels of inspection.

Quality is cost reduction

Any company that is using 100-percent manual inspection to protect its customers is a company that's pouring money down the drain. Companies may use this approach temporarily (i.e., for a few days), but beyond that it's an expensive way of avoiding having to think through your processes and fix them.

During my time as a quality manager, two comments from suppliers would always scare me:
• "We have instituted 100-percent inspection as a corrective action for the defect we sent you."
• "We have just instituted a rapid cost-reduction program."

In the case of 100-percent inspection, I knew this was an indicator that the supplier didn't understand the central role quality plays in reducing cost, and that the supplier's profitability would suffer along with my supplied quality product.

When a rapid cost-reduction program was announced, I'd tell my team to brace for a wave of junk as the supplier allowed untrained people to produce our product and cut out inspection or process

control activities without thought.

Sadly, I was rarely wrong.

Iterate or die

Using the five tools outlined above isn't a one-off project, or an isolated activity for when something has gone wrong. Like most good business practices, these processes demand the boring, constant, and relentless routine of questioning the spending of every cent, and the moving of every part to eliminate waste and ensure quality. Initial breakthroughs can be rapid and significant, but once your manufacturing processes are under control, you'll need to commit to continual iteration of these five tools to continually improve and evolve to a new level each day.

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