THE FOUNDATION OF QUALITY AND COST REDUCTION IN MANUFACTURING

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Images courtesy of Flexco, a company that has been making conveyor belt products for more than 100 years.

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

This is how it can feel some days. "We can't reduce costs any more!" I hear this mantra from manufacturers often. Other businesses say similar things, too!

This is also the real world of not just competition, but also technical development.

When I worked at Holden, there was a calculation done prior to the launch of the VT Commodore in 1997. The calculation showed that as a multiple of average weekly wages the VT commodore was cheaper than the first Holden that came off the assembly line in 1948.

Think about that for a moment.

With all the extra capability, features, comfort, safety, 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 that 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 is about explaining the five key tools that should be used to help you customise and adapt your business to keep providing more and more value in a commercially sensible fashion for you and your shareholders.

1. DFMEA

Starting at the beginning, a design for a product has been created. We would all like to believe that we have 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!" Absolutely. There is a step prior to that 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 Effects & Analysis. This is a 'war gaming' exercise to systematically analyse the design and help us proactively improve the situation.

What we are looking at are three criteria:

1. How severe an impact a failure would 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 criteria is evaluated on a score of 1-10. '10' is reserved for an absolute certainty of occurrence or catastrophic impact of failure and '1' is 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 0 and 1000.

Potential Failure Modes are ranked according to the highest RPN number to lowest, and we evaluate how to improve the RPN so that upon a reassessment the RPN number has been reduced to an acceptable level.

The first question we are asked when we run this as a workshop is: "What is an acceptable level?"

You choose that based upon the risks you are willing to take. There are guidelines for this available, and we customise these with clients as there are always local regulatory and cost impacts that must be considered, as well as the brand reputational perspective.

2. Process Flow Chart

After we have 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 add.
- Transport or move.
- Inspect or check.
- Delay or wait.
- Decide or review.

Having identified all of these steps we can then assess what we would change (minimise transport for example) in order 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 Flow Chart as well as the design drawings, we can then begin to utilise the Process Failure Modes & Effects Analysis tool.

We repeat the process of creating RPN numbers for each of the failure modes, however, this time we are focused on where the process of producing the parts can fail rather than the design itself.

Again, we rank them from highest to lowest and develop solutions. We modify the Process Flow Chart to reflect the new situation.

If we cannot reduce the RPN number in the PFMEA to an acceptable number by changing the process, then this is a 'red flag' to say that we need to go back and look 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 sows ear" comes to mind.

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

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

4. PCP – Process Control Plan

The PCP is the detailed quality plan for the production system. This document is based upon the design FMEA, the Process Flow Chart, and the PFMEA. The PCP shows us:

"It is not the strongest of the species that survives, nor the most intelligent that survives. It is the one that is the most adaptable to change." Charles Darwin.

- Exactly who will conduct the checks on the production process.
- How they will do it.
- How often it will be done.
- What tools are used.
- What measurements are 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, etc.

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 am 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

The detailed work instructions for the operator should only be commenced after a draft PCP has been established and the Process Flow Diagram has also reached a level of maturity.

This document should be a detailed, yet simple to use, document so that it can be used

to train new operators, and refresh more experienced people when there are changes, or upon returning from leave. The work instructions should detail at least the following information:

- All of the steps required to be performed.
- The safety precautions that must be taken (PPE).
- Gauging and measuring processes.
- Packing and labelling.
- 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 they should be familiar with it and able to explain it to others.

What's the catch?

Sounds simple, doesn't it. Many businesses still do not use these tools, and it costs them.

Some businesses use some of these tools but usually it is 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 and update the analysis at least annually, based upon customer feedback form 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. The facilitators of (this is where QA should earn their keep) need to keep the process grounded and moving forward. The cross-functional team that contributes to this work will need to be prevented from becoming stuck in the mud. This process is about serving clients profitably, not a paperwork nightmare of excuses to do nothing.

As far as the workload goes, it is 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 do not seem so onerous. Definitely the stress levels are lower. If you have had a quality recall or major customer complaint, you have 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. The work will get done eventually, you may as well do it 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 Flow Chart. Anything on the Process Flow Chart that is not identified as 'value add' is up for interrogation as to why are we 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 Flow Chart and evaluating the impact of changes using the DFMEA, PFMEA, and updating the PCP and Work Instructions do not have to take a long time, however, they can ensure that you reduce the costs without damaging your clients or incurring future costs in rework etc., because defects began to slip through.

Regular, in-depth reviews of the Process Flow Chart will identify opportunities for cost reduction that will usually improve quality and reduce lead time. Reducing transport is an example:

If your product can be damaged in transport… it will!

If we can reduce the number of movements we not only reduce the cost of moving things pointlessly, we also reduce the chances of a stray forktruck tine damaging the packaging, or some other way we can totally waste all of our good work so far.

We'll do this for new product moving forward!

Applying these tools on current product is where the most immediate gains will be made. You do not have to (initially) look at every aspect of the process, focus on where you know you have quality issues that cost (customer complaints), where you have non-value added activities (Process Flow Chart), or at any process that creates the need for increased levels of inspection.

Quality is cost reduction

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

As a former quality manager, there were two pieces of correspondence from suppliers that would scare me.

- "We have instituted 100% 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% inspection, I knew this was an indicator that the supplier did not understand what central role quality plays in reducing cost, and that their profitability would suffer along with my supplied quality.

For the occurrence of a rapid cost reduction program, I would tell my team to brace themselves for a wave of junk as the supplier allowed untrained people 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 is not a one-off project, or an activity for only when something has gone wrong. Like most good business practices it is a boring, constant, relentless routine of questioning the spending of every cent, the moving or every part to eliminate waste and assure quality. The initial breakthroughs can be rapid and significant; once you are under control, then it is continual iteration of the system to evolve to a new level each day.

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