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Traceability's Impact On Manufacturing

Knowing what went wrong and where could save money in future designs.

The consequences of field failures range from mild frustration to total disaster. If a low-cost consumer gadget fails, it is annoying but hardly fatal or life threatening. Should an avionics fuel monitoring and distribution system break down, however, the result is headline news.

Clearly manufacturers of sensitive hardware must either build multiple redundancies into their products or trace every aspect of the product's build and subsequent life, or both. The automotive, medical, avionics and military sectors have used such techniques for years. As consumer markets expand, the risk of failures causing a loss of confidence or high costs means manufacturers must be able to respond instantly to any unexpected negative stimulus from the market. Many firms are adopting Lean Manufacturing or Six Sigma techniques to tighten quality and output speed. Should a defect occur in production, the risk of rapid proliferation is now quite high. Therefore, traceability has influences inside (production arena) and outside (consumer arena).

Internal traceability. Many manufacturing plants using Lean or Six Sigma techniques are highly automated, high-volume operations. Defects can easily occur quickly and a large number of defective products can still be classified as Work In Progress before a fault is discovered. Therefore, the ability to instantly trace back when an out-of-control signal is detected is essential to avoid excessive waste and rework.

Faults can occur everywhere in a production line. The choice of defect sensors and their position determines the effectiveness of defect data capture. There should also be a method of feeding the fault data back to the element in the production line that caused it and then introducing a permanent correction.

In this context, traceability is not merely detecting and correcting a defect, but also recording its occurrence and statistically compiling permanent records so that trends can be observed and a longer-term correction engineered into the product, thereby tying in traceability and DFM.

Weak elements of the production system will also become evident and can be planned for enhancement or replacement at a convenient time. Traceability is an important tool for continuous improvement. When internal controls are tightened, the risks of defects escaping into the market and costs spiraling out of control are drastically reduced.

External traceability. The classic case for using traceability once a product has left manufacturing is to monitor what caused the defect and determine whether it could reoccur and the (likely) impact.

Thus the importance of logging every batch of components, materials, supplier changes, etc., in a consistent manner and also monitoring the production systems so that date, shift, line and staffing information is recorded. Once these data are captured, it becomes relatively simple – assuming that the data storage medium is large enough – to trace back to the component level. And once you've learned about a previously unknown defect, you need to determine how many others could be affected.

If a latent failure occurs after the product is established in its market it is still possible to judge the effect of further failures and make the appropriate decision.

If the potential failure is safety-critical, act promptly on all possibly affected products and initiate recalls or on-site repairs. If the product has a limited market life, the impact of a recall may be too great a cost burden; one might decide to simply introduce a replacement earlier than anticipated. If this is the case, traceability data collection will also permit future designs to avoid earlier pitfalls.

Many companies have so far avoided implementing traceability because it has no obvious value-add. However, after considering the possibilities of productivity gains, elimination of risky components or materials from future designs, minimized product recall campaigns and increased customer satisfaction, the investment begins to be justifiable. ■

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