THE REAL COST OF POOR QUALITY

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Introduction:

Quality Increasing Demands and Preventing a quality incident from snowballing

The aftershocks of the 2016 Samsung Galaxy Note 7 recall are still rippling through consciousness of manufacturers. Concerns are well founded, owing to the magnitude of the costs involving profits, labor, materials, processes, as well as reputation. Together, they reflect the “Cost of Poor Quality,” or as often referred to: COPQ. On final analysis, the problem was that awareness that something was wrong arrived too late to be handled effectively. This paper examines what leads to costly poor quality scenarios, and how they may be avoided through implementation of appropriate automated monitoring mechanisms.

The Challenge:

Too Little Known Too Late

During the course of production quality issues are bound to occur, but the real issue is whether they are “nipped in the bud” or evolve into much bigger problems. Parts can manage to slip through the full manufacturing process, to be discovered only when it’s too late that they are defective. Ideally, such discoveries are made before shipping. However, how early in the production process they are caught makes a significant difference in how high will be the cost to respond to them. These “Internal Failure Costs” include:

- Error Assessment — activity necessary to determine the causes of failure.
- Resource Waste — track and trace back all involved materials (inventory materials, work-in-process and finished parts discarded).
- Scrap — defective product or parts that cannot be mended, used, or sold.
- Rectification — reproduction of the part(s) and products, also known as rework.

<u>Recall Scenarios</u>
Another problematic scenario is when a supplier knows of or even reports a faulty batch of material or component to the manufacturing facility. The challenge arises as to whether the parts, assemblies, and kits made from these defected materials or components can be identified early enough to be corrected and still deliver orders on time, and yet affordably enough to remain viable and profitable.

<u>Disruption to the Manufacturing Schedule</u>
Another example is related to the fact that many of the processes and machines are built and designed to handle several kits or batches at a time, or per cycle. When manufacturer detects a defective part caused by raw material defect, just before it needs to go to the next station (for example, an autoclave curing), it throws the manufacturing schedule off course, leading to bottlenecks and delays.

It becomes evident that the critical differentiator as to whether a manufacturer can handle the discovery of a flawed part or kit, or even absorb a recall, is how early in the production process the defect is discovered. The further the flawed material, component, or batch has moved along, the more disruptive it is to the manufacturing schedule, and the more financially prohibitive.

The Solution:

Early Problem Identification

Timely Quality Assurance

The answer to the question how to identify quality issues early in the process without incurring the additional costs of expanding the employee roster and interrupt the manufacturing flow lies in advances of innovative software and Industrial IoT-based sensors. Software that is connected to sensors affixed to mobile assets on the production floor and monitors WIP (Work In Process) materials, kits and parts as they move along from one production station to another providing managers and operators with alerts that can prevent quality problems even before they occur or evolve into bigger issues. For example, composite materials that require below-freezing storage, can be tracked as soon as they are supplied and each time they go in/out of the freezer, thus have their remaining shelf-life monitored. Based on their location and condition, an alert is automatically sent to stakeholders when material is about to reach a threshold. To prevent a snowball quality incident, automated cloud-based tracking systems can be put in place to test for the quality and compatibility of each material (kit, or part), when they arrive at the production plant (or even before, when they leave the supplier), safeguarding product quality is never compromised starting as early in production as possible, thereby reducing quality faults and allowing early stage identification should one occur.

Digital Thread and Digital Traceability

Such a system provides a clear advantage over manual inspection in saving labor and increasing speed and is depended upon for accuracy on digital traceability, through the ‘Digital Thread’, referring to using innovative manufacturing optimization software generating virtual identical copies of physical assets used in production (AKA as the ‘Digital Twin’). The full record of their evolution, which draws on data from sensors installed on the objects to represent their status, working condition and position in real time, as well as their entire history throughout the production lifecycle, is monitored and logged throughout their entire lifecycle. The digital thread provides the two-way part traceability that enables quality control and assurance through every stage of production, from raw material to finished part, and back from part to raw material. In the Samsung case, had they used digital tracking and traceability, most likely that the original battery manufacturing error been caught and traced early enough in the production process and a recall would have been limited between the specific battery supplier and Samsung, possibly averting a recall of the finished product from the market entirely.

Predictive and Preventive Over Recovery

However beneficial early detection of errors and traceability provided by the Digital Twin may be, from another perspective, its greatest benefit may be prevention over recovery. The serious threat posed by complex and costly materials expiring is indisputable. If “parent” materials are not being constantly monitored and put into production on time, every part and kit further down the production line will “inherit” the potential defects associated with the expiration - or any other fault - with each stage of production passed making it increasingly difficult and costly to rectify. These threats are being mitigated by Industrial IoT (IIoT) cloud-based automation software that takes a predictive approach by using AI (Artificial Intelligence) algorithms on information collected from the factory floor or the different production platforms already in place. With IIoT-based tracking and traceability software integrated into sensors and the plant’s existing systems, use of materials can be readjusted time and again to accommodate ever changing production needs, while at the same time, ensuring materials closest to expiration are consolidated and used first, avoiding both errors and waste alike.

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Such a predictive and preventive approach may be viewed as one of the biggest opportunities that has been identified in the Smart Factory.

Summary:

Early Stage Problem Identification

Once a production facility is inter-connected and automated with the Digital Thread information at hand, alerts and notifications received in real time ensure a fast response to quality risks and stop it from spinning out of control causing direct and indirect adverse impact as they disrupt the manufacturing schedule and reduce the overall capacity. With digital tracking and traceability on hand, even when the unexpected happens, quality control is maintained, allowing for a quick reaction with minimal production disruptions and delays.