Reducing Waste

Integrated Systems Engineering

888-540-6024

www.essentialinsight.net

Introduction

In this discussion we address five prevalent issues which are key performance indicators of increased production costs. With each issue, there are a myriad of underlying factors, most dependent upon the industry and products being produced, however, there are always a few common facts that relate these key performance indicators to any production environment. All the issues pertain to the elimination of "waste" in various forms, the number one driving force behind the Lean Manufacturing philosophy.

Issue: Excessive Scrap

Excessive scrap is an insidious problem. It is almost always caused by some combination of three issues, the robustness of the process, operator training, and raw material quality problems. The biggest problem is to sort through what information you have about scrap to be able to identify the root cause. The scrap cause can usually be narrowed down to a specific operation in the manufacturing process, so that is the first place to start. Just observing the process operation is imperative to differentiating the root cause. However, be mindful, that by observing the process, operator behavior may change. It is human nature to do things "by the book" if you know you are being watched (witness the behavior of automobile drivers who are aware of a speed trap!).

Example:

A manufacturer had their operators on an assembly line rotate though the workstation each hour. Scrap rates did not vary much from day to day, but the primary scrap cause was a pre-threaded blind hole for a fastener being stripped out, causing the entire prefabricated assembly to be discarded. The tooling used to install the fasteners was controlled by electric torque controllers and data was collected on each fastener for statistical process control and assignment to each work piece. By reviewing the tooling data for the specific fastener, it became readily apparent that the number of failed fasteners occurred during one hour of the production day. This correlated to a specific operator's time at the workstation installing the specific fasteners in the blind hole. The issue was the operator was of very small stature, was unable to see the fastener hole to start the fastener, and instead, did it by "feel". This difficulty was exacerbated by the fact the operator stature did not allow them to adequately absorb the reaction torque of the tooling necessary to install the fastener successfully. The result was stripped pre-tapped holes in a prefabricated assembly and lost production. This scrap issue was solved by minor adjustments to the work area to allow easier access to the fastener position and adding an ergonomic support to the tooling to absorb the reaction torque.

Impact:

Through automatic collection of the tooling data across the entire process and creating reports in real time, production engineers are able to analyze the data, detect the patterns, determine a root cause, and take timely action. The total scrap was reduced by 70% by eliminated the problem of the stripped threads in the prefabricated assembly.

Issue: Too Much Rework

Many times the amount of rework is not recognized because the finished goods output is nominal because of the rework. That might sound like double speak, but, because a work piece can be shunted aside and repaired later or repaired in a separate transport loop, the fact is, a repaired work piece is counted as a finished good. This can mask the resources required to operate the repair process. This is especially true in a Just-In-Time production environment where a missing finished good can delay shipment and could incur large financial penalties from the customer.

The obvious idea is to correct the process such that the repairs are rendered unnecessary, but to do that you need empirical data to identify the high priority problems to correct. The Pareto Principle or 80/20 rule suggested by Juran, would indicate that 80% of the total repairs made are due to 20% of the defects. Thus, to eliminating repairs says you should find the most costly production issues driving repairs and solve them first. To do that you need to have some empirical data as to what is being repaired. Some repair causes may be obvious, but others less so, but just as insidious.

Example:

An automotive seating manufacturer developed a system to track seats through the assembly and inspection process. At the inspection workstation, data was recorded from automatic test stands, and operators required to enter other data associated with functional and visual defects. Defective seats, two to a pallet, were then routed to a repair loop where the repair technicians received an electronic punch list of what to repair. The initial defect data was astounding; fully 35% of all products produced were routed through the repair loop.

Impact:

By reviewing just two weeks of the inspection data, repair operations were reduced by 30% by modifying the assembly process with the addition of error proofing and other workstation changes to minimize the opportunity for the defect in the assembly process. As a result of automating the collection of inspection data, it was continuously available to production engineers to monitor defect trends, allowing them the opportunity to take pre-emptive action immediately.

Issue: Slow Workstation Cycle Time

When a new production process with manual labor is designed, there is a great amount of effort spent defining the time required by an operator to accomplish the work elements at any process operation. The work elements are combined across a line to achieve a balanced line. This is accomplished by using theoretical design data, building prototypes and timing operations, and the experience of the process designers. Cycle time represented by a transport time to move the work piece from one workstation to another and the service time to complete the work elements at the workstation. Lean Manufacturing principles indicate the importance of cost of transport time and motion in the service times, hence, the desire to minimize each to the extent practical. However, after a process is approved, assembled, and commissioned, the real work begins.

Example:

A manufacturer had a system to track all the work pieces through a mixed model production process. Production information was automatically collected and stored for each work piece, including the time a work piece entered a workstation and the time when the operator had completed all work elements and released the work piece. Merely as a consequence of tracking the work piece, it was possible to time tag several of the work elements within a workstation. Since the system was already in place to track the work through the production process, collecting the additional work element data was a very easy thing to do, as the infrastructure was already in place to capture the additional information. All of this data was aggregated to provide reports of workstation efficiency, delineated by work piece model, workstation, and user specified time ranges.

Impact:

The production engineers were able to use this data to identify and correct workstation issues due to engineering changes to the product, personnel changes, and equipment wear. The work elements at the workstations were modified to achieve an optimized configuration, resulting in lower labor requirements. The cost impact on operations, however, was significant. Because a lower staffing level was required, the direct cost of the finished product was lowered; hence, the system resulted in a payback period of less then two months.

Issue: Inaccurate Materials Inventory

Nothing can ruin a production manager's day faster than running out of raw material and being forced to stop production. The costs associated with this event are generally known and are very, very expensive. Conversely, maintaining too much safety stock may make life easier, but, masks inefficiencies in the production and supply chain management systems, and ultimately affects profitability through reduced cash flow and increased financing costs. Clearly, maintaining the proper amount of inventory is the right thing to do. Defining the reorder points for all the materials in your product is straightforward and most modern MRP/ERP systems order materials automatically using EDI methods. The more complex issue is accurately updating the inventory counts to reflect the material available and trigger the reorder points.

Example:

There is a manufacturer who made not only the finished product, but, a major subassembly as well, and was "losing" the subassembly while in storage. The subassembly was foam molded material which was manufactured in batch approximately one to two weeks prior to anticipated use, then stored in one end of the production facility in stackable 5'x5'x 5'boxes. Because the product was so light, the stack height of the boxes was limited only by the vertical reach of the forklift used to create the stack of 5 boxes. Each box had a label with a barcode and text indicating the SKU and count of the material in the box. Nonetheless, the warehousing area of the facility was a sea of stacked boxes! As usual, some SKU's were used less frequently than others, consequently, they typically were difficult to find, and were many time literally declared "lost" causing a finished goods inventory shortage or work stoppage. The issue was solved with a small Automatic Storage and Retrieval System (AS/RS) with crane delivery time optimizing algorithms to keep track of the location of the material and deliver it for use within seconds of its order. The ordering process was automatically tied to the finished goods production schedule such that the proper subassembly material was automatically delivered to the workstations synchronized to the production schedule.

Impact:

The subassembly material build schedule was modified to build to stock, so there was always enough stock, and, it never got "lost". The storage space required was reduced by 50%, freeing up floor space for a new production line that was installed a year later, eliminating the need to expand the size of the building. The return on investment of this project paid for the entire project in three months of operation.

Issue: Inefficient Production Scheduling

Whether a production facility is building to order or building to stock, inefficient production scheduling is a costly problem. Many times the issue is that orders are placed electronically via EDI[5] standalone mechanisms or via integrated ERP system. Errors in converting orders manually to a production schedule in a build to order production environment can lead to shipping the wrong product to the wrong customer at the wrong time and becomes evident very quickly. However, in a build to stock production environment where finished goods are being produced to replenish stock that has been shipped, the inefficiencies can be harder to discern, but lead to the high costs associated with maintaining unneeded inventory.

Example:

A manufacturer was producing finished goods to stock. Orders were received by a very sophisticated ERP system which tracked orders, material inventories, finished goods inventories, financials, and other data about business operations. However, the orders were converted manually to a production schedule and disseminated weekly to production. The customer was carrying several million dollars in the wrong stock because they were not able respond to stock levels as product was sold in a timely manner. They shortened the order time to the production facilities from once per week to real time as the orders came in, and eliminated the manual schedule to improve accuracy. Since they were already tracking the production through the process steps and had a measure of finished goods, a web service was implemented to which the ERP order tracking system could subscribe to schedule production and receive exact finished goods counts for tighter finished goods inventory control.

Impact:

This implementation reduced the required inventory safety stock levels by 25% and lowered storage space requirements by 35%. The return on investment was such that the project was paid for in less than six months.

Conclusion

All the discussion of these issues has a common thread. In each case, there was automatically collected data available from which to make an informed decision. All the collected data had context, ancillary information like time tags, such that it provided a view of what, when, who, and why of the production process. Consequently, the data could be viewed in aggregate across a production process to find waste associated with interrelated process steps, or with respect to a portion of the production process to analyze specific behavior. By correlating the data to key performance indicators, these manufacturers have a real time and historical decision support system to allow them to analyze their production process to identify the "waste" and reap the benefit of eliminating it.

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