

Maintenance Impact on Product Quality

By Ricky Smith CMRP

Maintenance of facility equipment and process/production systems and Quality of the products produced are more closely connected than most managers may understand. The potential financial gains from improving product quality can far exceed a company's maintenance budget. Production losses such as rejects, waste, and substandard quality directly impacts the bottom line or profitability of a company. Quality of a product can be impacted by various influences: human factor (operator errors), raw material (substandard material), shipping and storage, sampling and measurement of quality, and facility/production equipment reliability. Equipment reliability is focused on here from both the maintenance perspective and from a quality perspective relative to how they impact the business profitability. This article will identify possible remedies for companies with reliability and quality problems.

First, we must define what quality areas we are specifically talking about. One type of quality is the quality of the product a company may produce. The quality, as well as the function, of a company's product defines the price they can ask and thus determine the edge a company may have on their competitor. The other type of quality is the effectiveness in sustaining reliability of the company's performance of maintenance. The quality of the maintenance directly impacts the quality of a company's products.

Equipment reliability directly impacts production capacity for the following reasons:

1. Equipment outages, because of unscheduled downtime, in most cases results in loss of the opportunity to sell a product that could have been produced during this time period. This results from lost run time and also the reduction in quality as process is brought back up to full product specifications. This can add up a significant loss over the period of one year.

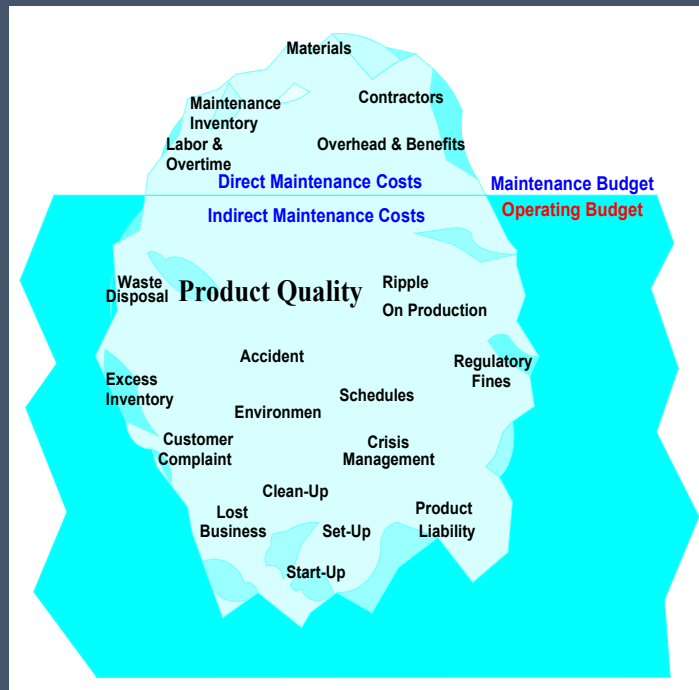
Example: In the particleboard business, in the US and Canada, most companies are selling all the product they can produce at this time. However, equipment reliability presently accounts for 3-10% lost production time each year which equates to millions of dollars in lost revenue and the resultant reduction of profit. Each time the press, forming line, or stacker stops even for just a few minutes it can take thirty minutes to two hours to return to full production specifications thus resulting in loss of quality during recovery and reduction of the bottom-line profitability of an organization. A Particleboard Plant for a company I will call ABC company found that, in one of their plants, this loss in revenue due to quality and lost production, just as the result of equipment reliability issues, cost the ABC plant over \$3 million per year.

2. Equipment stoppages because of unscheduled downtime, either through direct failure or the failure of facility support systems, sometimes impacts the bottom-line profitability only through product waste. The product that is produced is not sold out and a plant may use Saturday as a make up day when equipment reliability causes production to lag schedule. The waste is measured in most companies but is not viewed from a direct loss of profitability perspective. The waste is due to poor quality from equipment stoppages and the time it takes for the process to return to a required quality output. Additionally, the losses due to excessive waste product, overtime, power consumption, and reduced equipment life are not measured.

Example: XYZ company makes cardboard boxes. They are not sold out but produce waste due to quality issues. Their revenue losses, even though they did not utilize overtime,

reached \$4.2 million a year. If we were to measure the losses with Saturday labor and facility operation to make up for production losses the number could grow by \$1.8 million per year. These figures do not include losses due to loss of customers due to late shipments. This is an area that is hard to measure and is a loss that can usually never be recovered.

Don Nyman, of Nyman and Associates relates Maintenance Costs to the Iceberg Effect. The losses due to quality fall below the water line and are not normally identified or measured as being impacted by equipment reliability or maintenance.



The quality of the maintenance being performed impacts product quality through equipment reliability and equipment ability to produce to quality specifications. Variations in our maintenance process cause variations in equipment reliability and performance. Taking some measurements of “Best Maintenance” Practices can give us an idea of what causes variations in our equipment reliability.

Best Practices Measurement	Causes of Variation		Solutions	
70% of equipment failures are self induced	1.	Lack of skilled workforce	1.	Skills assessment and training
	2.	Operator errors	2.	TPM/Operator procedures
	3.	Reactive Culture	3.	Change management
	4.	PMs not performed properly	4.	PMs must be managed as an experiment
30% of all labor hours should be on PM	1.	PMs not being performed to a standard	1.	Have detailed procedures
	2.	PMs not a high priority	2.	Measure PM compliance

90% of all work orders come from Preventive Maintenance	1.	PM Inspections are turning into repair activities	1.	Train personnel in proper PM execution
Emergency work is less than 2% of total maintenance labor hours	1.	90% + of all maintenance work is not planned and scheduled	1.	Implement a true planned/scheduled maintenance program
	2.	No PM schedule compliance	2.	PM schedules must be complied with within 10% of time allotted Ex: 30 day frequency/PM compliance to within 3 days

Courtesy of John Day, former Engineering / Maintenance Manager for Alcoa Mt Holly (recognized by many organizations for over 20 years as the best in maintenance)

If a company truly wants to implement a Quality Management Process, then they must ensure they identify the variations in the equipment reliability. We have attempted to identify areas of variation together with possible solutions, but the best way to identify and improve quality through improved equipment reliability is to:

- 1st – Identify whether an equipment reliability problem exists and whether it impacts quality?
 - Measure waste caused by equipment reliability issues. (Measure in dollars of lost revenue)
- 2nd - Perform a maintenance assessment to identify where the variations are in the maintenance process: ex: PMs, Planned Maintenance Schedules, Storeroom issues, emergency work, crew structure, etc.

MAINTENANCE / RELIABILITY ASSESSMENT
 Excerpts from "Rules of Thumb for Maintenance and Reliability Engineers"
 by Ricky Smith CMRP and Keith Mobley)

The biggest challenge organizations face is to know the status of their current maintenance and reliability process and developing a plan to close the gap between current and desired performance.

In the next few pages, you will be given specific questions to answer in order to define the gap between your maintenance and reliability process current performance and what is defined as "Best Practices".

All answers should be a "yes" if not then this area may need to be explored in more depth. If you are unsure about the question or answer, then the question answer is a "no".

Remember this assessment is only used to help an organization determine its gaps between current and desired performance.

It is recommended this assessment is performed with representatives from all state holders. This includes plant manager, maintenance and engineering manager, production management, operators, maintenance personnel, maintenance planners, storeroom management, etc.

Score totals:

0 - 500 = Total Reactive / Reliability principles are not understood or applied

- Need to educate all management and engineering in reliability and develop a reliability strategy for serious change. Need to develop a business case to define the opportunity immediately. attend training in Maintenance and Reliability Best Practices

501 - 700 = Emerging (long way to go)

- Need to develop a business case and reliability strategy with timeline, targets, and objectives.

701 - 850 = Proactive (continue the journey, you are headed in the right direction)

- Need to ensure continuous improvement process is built into your asset reliability process. Identify gaps in the assessment and fill the gaps.

851 - 1000 = World Class

- Hire an outside reliability consulting firm to assess your current stated and make recommendations for any change required. Great job.

3rd - Develop an action plan and timeline with benchmarks and performance metrics to reduce variations in the maintenance process to an acceptable quality level.



4th - As you measure, improve the maintenance process as required.

Maintenance Scorecard			
	Best practice	10/12/2020	YTD
Maintenance Schedule Performance	>70%	62%	67%
Maintenance Break In Work	<15%	38%	33%
PM/PDM Work Scheduled	> 30%	18%	35%
PM/PDM Compliance	>80%	36%	67%
Notification Entered from PM/PdM find	1 for every 6 inspections	2	3
Equipment Not Available	Weekly	0	1.45
P1 Notifications	Weekly	12	11.43
Core Shift Mechanic	Weekly	4	3.95
Polymer Shift Mechanic	Weekly	9	6.22
No Information P1's (Still open)	Weekly	0	1.55
		Shift & Core worked on 1 P1 together	

Companies that want to compete more effectively in today's market must be progressive and accept and implement change. Eliminating variations in the process and thus improving product quality can provide increased market share, add revenue (and profit) to the bottom line of a company, increase employee moral, and reduce costs associated with a maintenance program which is in a reactive state. A total planned maintenance program can pay for itself through the elimination of product quality variations.

Total Planned Quality Maintenance (TPQM) is not just a buzzword but is a philosophy that must flow from top management down in order to produce the effects that most favorably impact the bottom line. TPQM is a program of maintenance that can improve employee morale and effectiveness. It involves all aspects of maintenance including planned periodic, corrective and predictive processes. Quality Maintenance does equal Quality Products.

If you have questions or comments please send an email to rsmith@worldclassmaintenance.org

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