Lean Maintenance Maximizes Cost Savings

Howard Cooper
Maintenance Reliability Engineer
Amemco.net
Layton, UT

re your machine productivity levels and profits in danger of breaking down, unexpectedly? If you aren't practicing lean maintenance, the answer may be yes.

I urge you, whether you are a buyer, a technician or a manager, to immediately consider lean maintenance reliability methodologies to preserve uptime for the systems, machine tools and equipment you have and those you will acquire. It will increase your competitiveness by reducing the cost of doing business.

The cost of unscheduled equipment downtime in lean manufacturing environments, without excessive inventory buffers, is five to thirty times what it is in other manufacturing environments because it results directly—and immediately—in lost opportunity, failed shipping schedules and lost sales. Eliminating machine downtime and unscheduled maintenance, some of the largest, or near-largest, overhead expenses for any manufacturer, requires preventive maintenance—often confused with routine maintenance. While neither are new concepts, true preventive maintenance bears repeating in the context of lean manufacturing and related machine availability and waste reduction.

When I worked for John Deere in the '70s, long before becoming a consultant on maintenance reliability to other companies, I knew the precise hourly costs of downtime and tried to reduce it whenever I could. In today's lean world, the cost of downtime is 10–20 times higher. It's only after you have a firm grasp on the cost of downtime that you can calculate the impact of maintenance reliability methods that ultimately increase profits by decreasing the cost of goods sold. These methods can help companies become more price-competitive and increase their market share.

Even after decades of shared knowledge in preventive maintenance techniques, downtime still occurs more than it needs to. Too often, maintenance professionals are called upon to fix equipment only after there is a problem. This reactive approach results in unnecessary work. You can monitor it, measure it, log it, track it, and attack it, but downtime won't go away until you eliminate the stresses that cause it. Had you prevented downtime in the first place, there would be more time for value-added pursuits.

The answer to increasing the reliability and uptime of equipment used in lean manufacturing environments can be derived from Six Sigma's Y=f(x) analysis and DMAIC (explained on the next page). The Six Sigma-based lean maintenance model gives manufacturers an effective way to view the whole concept of true preventive maintenance.

At John Deere, we used this SS Problem/Cause thinking, Y=f(x), and five years of maintenance-log information to determine the seven root causes of most unscheduled downtime, scrap and rework (low yield). Further, Six Sigma's DMAIC helped us determine ways to eliminate or protect against each root cause. My work as a consultant to other companies using these methodologies has now helped eliminate these root causes in many facilities, resulting in a 70–92% reduction of unscheduled downtime. With proper expertise, these methods can be implemented in 30–60 days, but, with few skilled maintenance technicians in the workforce—and most nearing retirement—it is critical that more of today's professionals learn how to apply basic maintenance techniques to protect equipment *before* malfunctions, failures, and unscheduled downtime occur.

In the formula, Y=f(x), Y (the problem) happens as a "f" function of "x." Y is the dependent output variable of a process. Once quantified through Design of Experiment (DOE), a transfer function Y=f(x) can be developed to define the relationship of elements and help control a process. When applying the equation to maintenance, Y represents the result—for example, Y=downtime, scrap, and rework. "Y" is caused by or happens as a function of "x."

Traditional approaches to identifying the cause, effects and results of each downtime situation often lead manufacturing and reliability professionals down the wrong path. They often end up chasing any number of failing components, or assemblies, as the cause of each downtime incident (for instance, bad axis drive board resulted in scrap and downtime.) In these situations, though, they still

haven't identified the original root, or chronic, stress that caused the problem. When the few basic stressors for every downtime situation are known, it becomes easy, with some expertise, to eliminate them or harden against them to prevent future related downtime, scrap and rework altogether. You can prevent "x," or chronic stress, thus preventing downtime, Y.

Lean maintenance reliability professionals created a method for helping managers begin pulling away from predictive maintenance and move toward stress elimination and maintenance reliability as goals. With experience, each machine and control system can be analyzed to determine which basic stresses may affect each machine over time, and to prescribe a protective or hardening solution to be implemented to protect each piece of equipment from the stresses to which it is subject.

Six Sigma's "DMAIC" guideline serves as a roadmap for this procedure:

- D—Define the problem
- M—Measure the problem
- A —Analyze how the problem can be eliminated
- I—Implement the solution
- C—Control the solution to ensure its continuance and improvement, if practical

At John Deere, the DMAIC model helped this writer reduce unscheduled downtime by almost 80% in just over two years. Eliminating stressors—like heat, vibration, dirt build-up, oxidation, hydraulic contamination, power surges, etc.—increased the mean time between failures, prolonged reliability, and increased machine availability and uptime. Since then, the lean maintenance reliability method has been further developed with exact means for protecting, or hardening hundreds of different machine and system types, making it possible to implementing plant-wide solutions in as little as 30 to 60 days. Frequent results include:

- Reduced mechanical downtime by 50%—permanently
- Reduced hydraulic systems downtime by 80%
- Reduced electronic systems downtime by 92%

You may be able achieve the same, or even better results—if you manage it right. And the Society of Manufacturing Engineers is now working to help you. SME is forming a tech group on lean maintenance reliability within its Product and Process Design and Management Technical Community. The group will bring current and future lean maintenance reliability professionals together to ensure critical knowledge of lean maintenance methodologies is not lost. Participants will share information and best practices in lean maintenance reliability—practices that can help you do business better. Don't miss out and let maintenance become your company's Achilles heel.

Product and Process Design and Management

ndividuals with an interest in product and/or process design, management, improvement and collaboration can gain a lot by joining SME's Product and Process Design & Management (PPDM) Community. Currently chaired by Michael C. Burstein, PhD, CEI, president and CEO of T.I.P.E. Inc. (West Hampton, MA) the community's mission is to create, refine, and exchange advanced ideas about designing, managing, and manufacturing products and processes on a global scale. Members leverage one another's knowledge and creativity, sharing pre-competitive research, ideas and successes, and identifying manufacturing needs.

Members of the PPDM community accomplish their goals using methodologies ranging from idea generation to design, specification, sourcing, prototyping, facilitizing, tooling, planning, manufacturing, inspection, feedback, and continuous improvement throughout the value chain.

The Community offers technical groups delving into:

- Lean manufacturing enterprise
- Lean tool and die making (also associated with the Forming and Fabricating Community)
- Human side of lean
- Lean curriculum and certification
- Lean job shops (forming)
- Lean maintenance reliability (forming)
- Process design and automation
- Concurrent product design (forming)
- Product data management
- Product design and automation
- Productions systems and management techniques
- Quality manufacturing oversight
- Supply chain management

Help shape the direction of these evolving disciplines by joining SME and its PPDM community today at www.sme.org/join or www.sme.org/ppdm.