Lean Asset Management — Is Preventive Maintenance Anti-Lean?

Olin Thompson - December 20, 2004

Introduction

Lean manufacturing has been widely accepted as an approach to business improvement. The business benefits of lean have been extensively documented. Asset management should play a role in lean.

Lean manufacturing's focus is eliminating waste, for example:

- Inventory—Inventory must always be minimized.
- Defect correction—Resources spent on defect correction are waste.
- Unnecessary processing—All unnecessary activities, particularly non-value-adding ones, are to be avoided.
- Unnecessary motion—Materials and *work in progress* (WIP) should follow a minimal path through the factory.
- Transport—Transport of materials should simply be avoided. Time in transport does not add value.
- Waiting—WIP is to be minimized.
- Overproduction—Produce only if there is a customer demand

The Roll of Asset Reliability in Waste Reduction

Asset reliability can contribute to reducing waste in many of these areas. To reduce waste, assets must perform as expected and when expected. This means that failure must be redefined to mean an asset is unable to meet business objectives. The business objectives of the asset include running at the expected rate, producing product within the expected quality standards, and being ready when it is needed for production. If an asset does not meet these objectives, it has failed.

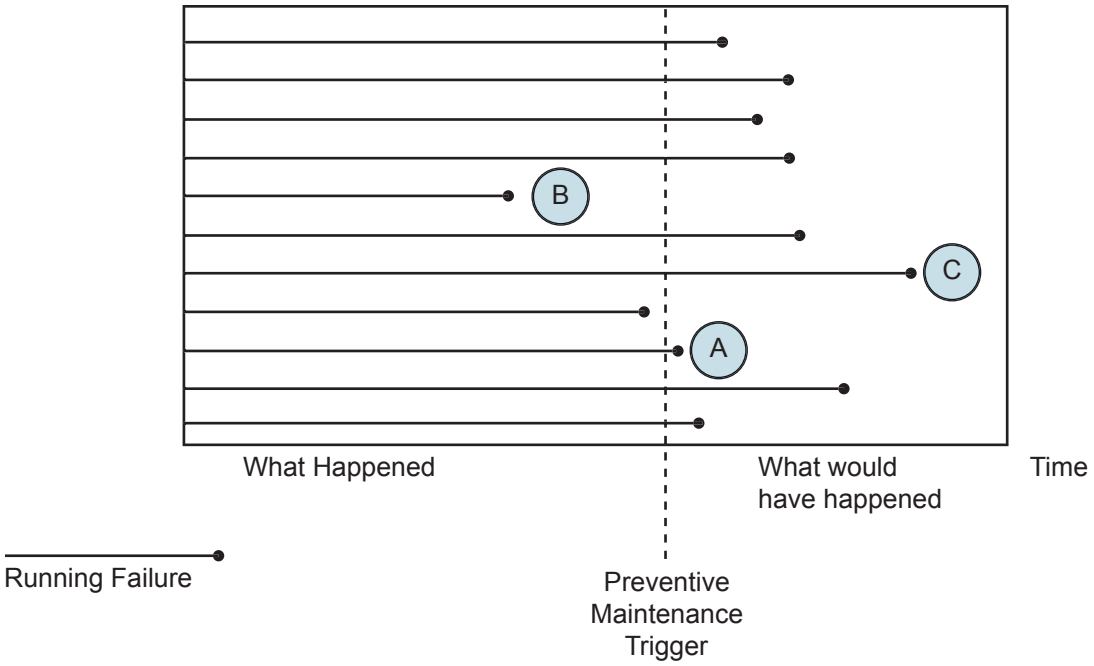
How can reliability eliminate waste? Machines that are reliable produce less scrap and product that is within specification eliminating the cause of defect correction. Equipment must be ready to run when demand is presented.

Preventive Maintenance Is Anti-Lean

Asset management systems have used the concept of preventive maintenance for years as a strategy to avoid unplanned downtime. Preventive maintenance uses time-based rules to determine when a specific maintenance task should be performed to avoid unplanned downtime. The unit of time is days, weeks, or months or a number of cycles of the asset (every 100,000 pieces, for example). Preventive maintenance has proven that it can lower unplanned downtime. But, applying the principles of lean tells us that unnecessary maintenance is waste. Just like inventory not needed at this time is waste, maintenance tasks done before they are required are also a waste.

When preventive maintenance tells us it is time to perform a maintenance routine, the question is, could we have waited or eliminated this routine without a negative impact on the asset's ability to meet the business objectives? We cannot know what would have happened after the preventive maintenance routine was performed, however, the chart below reviews the business aspects of preventive maintenance by showing a series of situations for a specific asset.

Each horizontal line begins with the asset's previous preventive maintenance or repair. The asset then runs for a period of time until the preventive maintenance trigger is hit. Lines which extend beyond the trigger point indicate what would have happened if we did not perform the maintenance routines dictated by the preventive maintenance trigger. We see three different situations, marked A, B, and C.



Since the preventive maintenance trigger points are set to minimize or eliminate unplanned downtime, they are conservative by nature. This means that the majority of preventive maintenance efforts are "too soon", creating an excess maintenance expense or a maintenance waste. Therefore, preventive maintenance is anti-lean. To provide lean maintenance, how can we plan maintenance to both avoid unplanned failures and minimize the its cost?

A—Just right	If the preventive maintenance routines had not been executed, the asset would have failed very shortly after the scheduled preventive maintenance time. In this case, preventive maintenance worked, avoiding unplanned failure at the lowest cost.
B—Too late	Before the trigger point was reached, the asset failed. We have unplanned failure, the asset did not meet its business objectives (an unacceptably high scrap factor for example). In this case, the preventive maintenance routines should have been done earlier than the trigger point. The company incurred waste in the form of bad product, excess run time, unplanned expenses, etc.
C—Too soon	Frequently, the asset would continue meeting its business goals well after the point where preventive maintenance was performed. In this case, excess expense was incurred because the maintenance activities could have been delayed. Excess maintenance expense is a waste.

Failure analysis reveals how assets fail and why. Numerous studies tell us that the majority—80 percent—of failures are not time based. The reason for failure is most often not time, and for most assets, there are numerous ways that it can fail. The concept of *reliability centered maintenance* (RCM), which has been proven since the 1960s, is

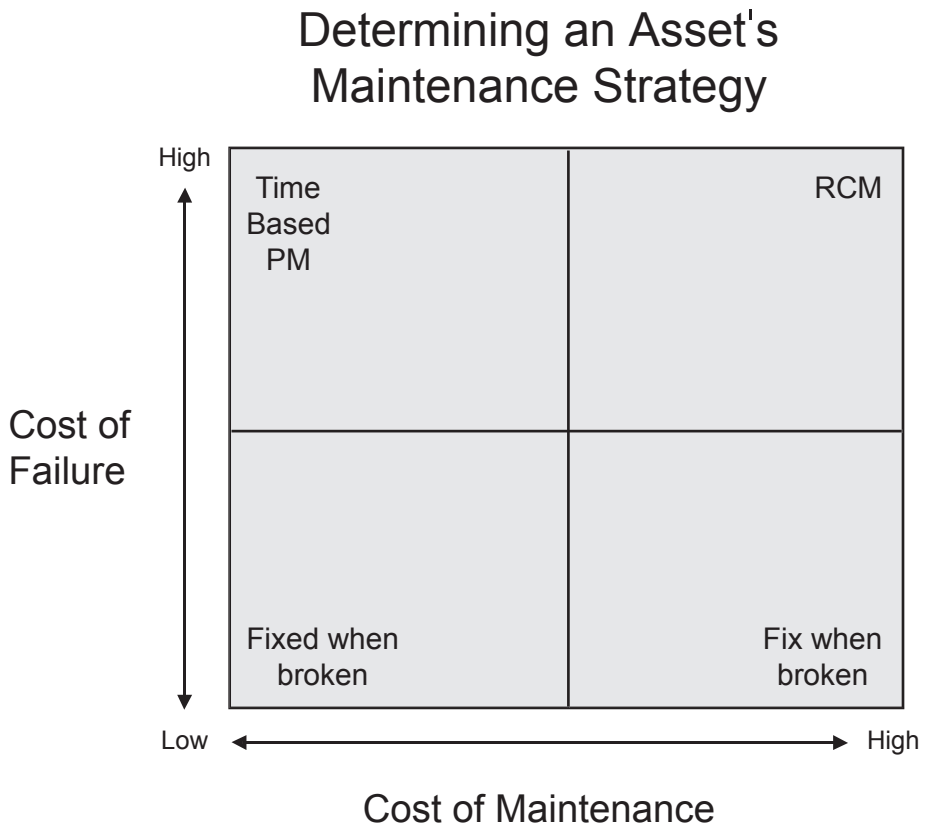
one methodology for understanding an asset's potential for failure. This concept is based upon determining how assets fail, why each failure type occurs, and the symptoms that indicate potential failure.

Understanding failures can also reveal the right work to be performed based upon the specific symptoms. By monitoring the asset with this view, we can detect the symptoms of failure and react to the symptoms with the right work. The result, as found in the airline industry, is assets that are less likely to fail and that require far lower maintenance expenditures.

It takes money to monitor the health of an asset. Monitoring means inspections, sensors, and enormous amounts of information that must be gathered and analyzed. The cost of monitoring the health of the asset, the cost of failure, and the cost of maintenance operations must be evaluated on an asset by asset basis. This analysis reveals that RCM is not the most appropriate for all assets. Other less rigorous methodologies exist.

Determining the Right Maintenance Strategy

How can we determine the right maintenance strategy for a specific asset? To meet the objectives of lean, we need to evaluate the cost of failure in terms of both not meeting business objectives and any extra cost due to the need for unplanned or even emergency repairs. We must also understand the cost of maintenance for the asset. Comparing these to dimensions gives us three alternatives maintenance strategies.



If both the cost of failure and the cost of maintenance are low, we can use the strategy of simply fixing the asset when it fails. If the cost of failure is low but the cost of maintenance is high, we need to minimize the amount of maintenance required and this may be best done by waiting for the asset to fail before we expend any maintenance cost. Where the cost of failure is high and the cost of maintenance is low, we need to be more proactive and accept more maintenance cost in order to insure that the asset will not fail. Here, a time-based preventive maintenance strategy works well. If both the cost of failure and the cost of maintenance are high, we need to use RCM concepts and manage the health of the asset to avoid failures while minimizing the maintenance cost.

Reliability software enables us to manage asset health effectively and efficiently (lean), monitoring the condition of assets using a combination of time based condition inspections and automated or on-line predictive and condition technologies. It is critical to be able to pull together all of the sources of condition data, analyze the data to determine the true health of an asset—and then recommend the right maintenance work to do based on the current condition. This is how the lean principle is applied to maintenance—focusing on asset reliability and using technology to enable us to achieve optimal levels of reliability at the lowest cost.

Summary

Lean is a proven approach to improving a business. Asset reliability can and must contribute to lean asset management by minimizing waste. Maintenance can help eliminate a number of different causes of waste by maintaining assets to do what is expected and when. Lean concepts and the elimination of waste can also be applied to maintenance. Lean concepts can help us delivery lowered maintenance cost and increased effectiveness. Asset reliability can drive lean maintenance concepts.

About the Author

Olin Thompson is a principal of Process ERP Partners. He has over twenty-five years experience as an executive in the software industry. Olin has been called "the Father of Process ERP." He is a frequent author and an award-winning speaker on topics of gaining value from ERP, SCP, e-commerce, and the impact of technology on industry. He can be reached at Olin@ProcessERP.com.