THE IMPACT OF PREDICTIVE MAINTENANCE ON MANUFACTURING

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Every single day, in every manufacturing environment, failures and downtime happen. That's just a reality when you're dealing with equipment that performs a repetitive task. The issue however is that manufacturing in today's markets requires efficiency and quality production. Unplanned downtime in just one machine, in a 'just-in-time' manufacturing environment, can cause delays that lead to unhappy customers, possible attrition of those customers to a competitor and a direct hit to a company's bottom line.

One of the truly great results of the growth of industrial IoT (Internet of Things) is the fact that machine data can be leveraged to limit the cost and impacts of downtime, both planned and unplanned. This is otherwise known as predictive maintenance.

What is predictive maintenance?

Predictive maintenance—or PdM, for short—is a method for anticipating maintenance requirements in machines on a factory floor. By analyzing operational data from the machines, patterns emerge that will allow operators to predict when maintenance will be required on any given unit, allowing for it to be planned during less costly times.

In the past, manufacturers would rely on reactive maintenance, otherwise known as the ‘if it ain’t broke, don’t fix it’ method. You can well imagine that servicing machines only when they broke down was a huge cost, both in terms of unplanned downtime and the potential impact to other parts of the machine, as well as the quality of the output for the time that the part was failing.

Predictive maintenance relies on specific information pulled from each machine, to detect potential problems. An example would be vibration analysis. A model that uses a baseline of collected performance data for a machine will be able to detect changes, such as an increase in vibration in a specific part, which could be caused by damage or the introduction of a foreign object. Deviations from the baseline allow operators to predict a need for maintenance before the problem becomes serious, resulting in equipment failure.

What are the advantages of predictive maintenance?

From a cost saving point of view, the advantages of predictive maintenance cannot be understated!

1. Optimizing planned downtime
2. Minimizing unplanned downtime
3. Optimizing equipment lifetime
4. Optimizing employee productivity
5. Increasing revenue

We’ll take a look at each of these in turn.

Predictive maintenance helps optimize planned downtime

Planned downtime can encompass everything from machine cleaning and oiling to replacement of parts that are known to fail on a regular basis. This kind of preventive maintenance reduces the risk of unplanned downtime. Just like taking care of your

computer and sweeping it for viruses, or keeping other appliances clean in your home, you'll get more efficient and better quality output from a well-serviced machine.

Thanks to the data collected in machine operations, preventive maintenance can be scheduled regularly and at times that will have the least impact to order production. There is also the added benefit that adequate maintenance of this nature will invariably extend the life on a machine that would be difficult, and costly, to replace. Maximizing uptime and the life of a component will ultimately result in significant cost savings.

Predictive maintenance limits unplanned downtime

According to a Wall Street Journal post, "Unplanned downtime costs industrial manufacturers an estimated $50 billion annually." Using predictive maintenance to limit this cost is critical in highly competitive manufacturing industries.

Inasmuch as scheduled preventive maintenance can ensure that machines run smoothly most of the time, monitoring machines digitally collects reams of data that, when analyzed, will show patterns on any given machine. This kind of pattern detection, based on historical data, can help to identify a machine that is likely to experience an outage, and for which maintenance can be planned proactively.

Predictive maintenance can help to optimize equipment lifetime

Being able to monitor a machine's efficiency, output and quality over time will reveal data that will identify when a machine requires maintenance, as noted above, but will also help identify when a machine is reaching the end of its life.

As machines age and depending on their level of use, the maintenance schedule will change, which can be managed through predictive maintenance. Parts of the machine will respond to production stress differently over time. The eventual

increase in maintenance that is predicted through data patterns will reveal when a machine is reaching a tipping point on cost vs. performance. The need to eventually replace large parts of a machine, or the entire unit, is made manageable by being able to forecast that need and plan for it, both from a cost / budget and time / effort point of view.

Predictive maintenance can help optimize employee productivity

There are many ways that predictive maintenance optimizes employee productivity. Firstly, let's just look at the the cost of the labor itself: when repairs are scheduled, the amount of time needed for repair is reduced because of a smaller number of component replacements instead of entire equipment replacement. Also, the frequency of repair for critical failure of equipment will be reduced and the amount of "critical callouts" will be greatly reduced.

From the employee's perspective, reduced breakdowns and accident avoidance systems which can alert or even halt equipment when there is danger to a worker, can dramatically improve factory conditions and minimize worker injuries. Furthermore, down-times, operation with sub-optimal parameters not only impact output but also impact employee morale. It is stressful to rush to solve problems when they arise. Predictive maintenance minimizes such instances.

Predictive maintenance can help increase revenue

The advantages of predictive maintenance we've covered above in the end all have the same goal: increasing the bottom line. With less maintenance on good components and quicker repair of faulty components, repairs can be more effectively handled, thereby reducing repair time.One of the most comprehensive studies on potential of industrial analytics like predictive maintenance was conducted by McKinsey in 2015, and they uncovered the opportunity of for the following improvements:

- 10-40% reduction in maintenance costs: Since planned maintenance is based on a schedule, there will be cases when maintenance tasks will be performed when they are not needed. Predictive maintenance can prevent such inefficiencies.

- 10-20% reduced waste: Sub-optimal operation that is not detected, can result in wasteful production. Raw material, energy, labor costs and machine time get wasted in such instances. Predictive maintenance systems can uncover issues that can result in waste before they arise.
- 10-50% new improvement opportunities uncovered: Once data collection becomes automated, new insights on process optimization opportunities can be uncovered daily through advanced analytics.

How to implement predictive maintenance

Now that it's clear that predictive maintenance is an assured way to avoid unplanned downtime and incur higher manufacturing costs, the question is: how do you implement a predictive maintenance plan?

First, get to the crux of what problem you're trying to fix:

- Are you more concerned about unplanned downtime or the cost of component failure?
- Are some machines on your floor more 'important'? ie: used more frequently, central to more orders, etc...

Then you need to assess your existing status, or create a baseline of data on machine performance. For this, you can use your own standards, OEE standards or other industry standards. Review each machine to see what the historical performance levels have been: how often has it been down, what components fail regularly, how often is maintenance currently scheduled and so on.

Second, examine the historical data for patterns and what metrics will indicate a problem, what deviations from the baseline should flag an operator and so on.

Finally, once you are using these patterns and the data, relative to your baseline performance measurements, you need to institute a process for continually updating the data and reviewing it to ensure that it continues to reflect current status and will flag deteriorating patterns that clearly signal a need for maintenance. This is the key: you can't predict what you can't analyze. **Accurate data is essential!**

Minimizing unplanned downtime, at least as it relates to the functioning of the machines, is a huge cost savings and will prevent delays to market that will also impact the bottom line. In today's manufacturing environment, predictive maintenance is not a 'nice to have'. It's a necessity.