

Getting Executive Attention and Support for Predictive Maintenance

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Summary

What does your CEO care most about? It's revenue and ROA. What is not a priority? It's not the number of maintenance technicians on staff. Unfortunately,

Having a positive effect on C-suite KPIs and shareholder value gets executive attention and support. Justification of predictive maintenance projects should focus on higher revenue and ROA. Those involved in maintenance would do well to tie maintenance KPIs to executive KPIs to obtain executive approval and support for projects.

most project justifications for predictive maintenance focus on reducing maintenance costs, which often fails to get executive attention and support.

Executives respond to their KPIs just like the rest of us. Their KPIs are in the P&L statement and balance sheet. Predictive maintenance prevents downtime and increases production capacity, which contributes to higher revenue. The justification for a predictive maintenance (PdM) project should start with this higher revenue. Next, is conserving cash in the balance sheet by avoiding replacement equipment and lowering work-in-process

(WIP) inventory – which improves return on assets (ROA). Improving revenue and ROA has a positive effect on executive KPIs and shareholder value – which gets executive attention and support.

Struggling with ROI for Predictive Maintenance

When attempting to financially justify an investment in PdM, those involved typically focus on what they are familiar with i.e., maintenance activities. The identified business benefit involves reducing maintenance technician time and replacement parts. Usually, the financial analysis comes up short,



with not enough return to justify the investment. A resourceful person will constrain the investment to get an acceptable ROI.

Set-up for Project's Perceived Failure

A preventive maintenance strategy typically applies maintenance at double the expected frequency of asset failure. In contrast, PdM applies labor just before the failure. Thus, preventive maintenance usually uses twice the labor and materials as PdM. The reduced maintenance cost is a common justification for PdM. But maintenance can always find more useful jobs to do. After PdM project implementation, the maintenance technicians are assigned other tasks with little or no reduction in headcount.

Production management will view the project as a success when they see a reduction in unplanned downtime and have more control of the production schedule. But, finance and the COO/CEO will view the project as a failure since there was no headcount reduction to realize the savings. Despite success from an operating viewpoint, the next project justification will be met with skepticism, which could be career limiting.

With weak savings, constraining the investment limits the available resources which increases the risk of technical failure i.e., the PdM project doesn't work or goes over budget. Another career-limiting factor.

PdM Justification that Gets Executive Attention

Moving beyond maintenance activities and into areas that improve the KPIs of C-suite executives may be outside the comfort zone of most maintenance professionals. However, this approach will improve project justification, increase available resources, obtain a higher level of success, and probably provide more career opportunities.

C-suite KPIs

Just like you, executives respond to their KPIs. In their case, a close link exists between the KPIs and compensation. Having a positive effect on these performance measures will get executive attention.

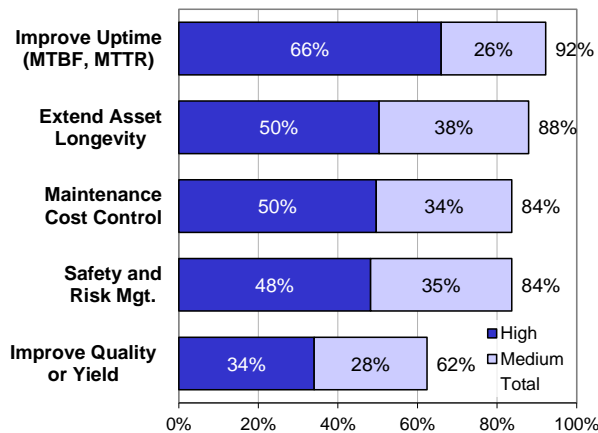


**Annual Report (Form 10-K)
Contains Executive KPIs**

Executive metrics are well defined via accounting standards and publicly known via the company's financial reports i.e., the profit and loss (P&L) statement and balance sheet. Any fudging of the numbers will get the executive in legal trouble – so improvements must be real and verifiable by finance. Improving these reports will get positive executive attention and support.

Connecting Maintenance KPIs to C-suite KPIs

Based on ARC Advisory Group surveys, the leading KPIs for the maintenance function are uptime (including avoiding onerous unplanned downtime), asset longevity, cost control, and safety/quality.



Ranking of Maintenance KPIs

Revenue

Unplanned downtime interrupts production, which leads to missed schedules, lower capacity, and reduced revenue. The missed promised delivery dates reduce customer satisfaction, which has a longer lasting negative impact on revenue. The uptime metric directly effects revenue and profits in the P&L statement; key measures of executive performance.

Balance Sheet

Good maintenance practices, including predictive maintenance, enables assets to operate longer. These assets remain on the books at a low, depreciated value. New assets are initially valued in the balance sheet at their acquisition cost. Not needing to replace equipment prevents an increase in the value of assets and conserves cash in the balance sheet.

Particularly in the discrete and batch process industries, work-in-process (WIP) inventory allows downstream operations to continue if upstream equipment fails. With higher reliability and near zero unplanned downtime,

the WIP inventory can be reduced. Lower inventory reduces assets and increases cash, which improves the balance sheet.

In both cases, i.e., inventory and equipment, assets are lower, and cash is higher. This improves the “quick ratio” metric that financial analysts use to value the stock – helping to drive higher stock price and shareholder value, which are also key measures of executive performance.

Return on Assets

A key metric for overall performance of a business is return on assets (ROA). This ratio contains the return (profits) in the numerator and total assets in the denominator. Using predictive maintenance to prevent unplanned downtime improves profits and reduces assets – both changes have the effect of increasing ROA. Again, this helps improve shareholder value.

Operating Benefits

How does predictive maintenance benefit the operating people? Answering this question gets broader organizational support and higher likelihood of project success.

Lower Risks

With PdM, the near-zero unplanned downtime avoids the risk of interruptions which allows production to more easily meet its production schedules. Preventive maintenance, in contrast, often has low effectiveness. Reliability studies by Nowlan & Heap and others show that 82 percent of assets have a random failure pattern¹. This random nature means failures will occur between inspections or preventive maintenance.

Reduced Maintenance Costs

Preventive maintenance must be performed more often than the mean time between failure (MTBF) of an asset to catch failures before they occur. Reliability practices recommend a frequency of twice MTBF. These regular inspections and related activities are needed at roughly twice the frequency that an asset truly needs maintenance. With PdM, maintenance occurs when it is needed. Thus, preventive maintenance is roughly twice as costly as

¹ *APM 2.0 with Industrial IoT*, Ralph Rio, ARC Advisory Group, Sept. 2015, pg. 14

PdM. A predictive maintenance application typically reduces the maintenance costs for the associated asset by half.

As an asset fails, a problem with a component can cascade into a much bigger issue. An example is a gear in a gearbox. Metal chips from one gear get into other gears and cause them to fail. A relatively small problem with one gear cascades into a big issue that takes a much longer time to repair or requires replacement of the asset – increasing the cost and extending the downtime.

Improved OEE

The overall equipment effectiveness (OEE) metric combines schedule, quality, and maintenance performance. OEE has become widely adopted for measuring operational performance. Better equipment maintenance has a positive effect on all three aspects of the metric.

- Reduced unplanned downtime improves production’s ability to meet their schedule
- Well maintained assets are better able to perform as intended and produce products within specifications for higher quality
- PdM improves maintenance KPIs while lowering costs



**Wireless Vibration Sensor
Monitoring an Electric
Motor for a Pump**

Source: National Instruments

Control PdM Project Cost and Risk

In the past, PdM projects involved expensive custom software with a high risk of technical failure. These applications usually broke as technology changed. With IoT, analytics, and cloud platforms, PdM applications evolved to become more standardized with a much higher success rate and sustainability. Considerations for a PdM project include:

- Well defined objective: Pick the critical assets, the business benefits, and focus on predictive maintenance, i.e., preventing unplanned downtime.
- Avoid custom software: Avoid technology risks and support issues with custom software by using a packaged software application.



**Wireless Access Point
Connects Wired I/O to Wi-Fi**
Source: National Instruments

- Focus on “small data” from specific assets: Focus the predictive maintenance software on the specific data acquired from the machine being monitored. This usually involves a small data set of parameters – in the range of three to a dozen. This data is relatively easy to acquire and manage. In comparison, starting with big data from everywhere is expensive, with high technical risk and an unnecessary major project hurdle.
- Include equipment data: Process data from the historian or other systems provides some of the needed data. Add equipment data for more robust predictive maintenance with lower false positives.
- Leverage wireless: Wiring for new sensors for the equipment data significantly increases installation costs. Since the application is monitoring (vs. control) wireless sensors are acceptable. Wireless sensors lower installation costs and improve flexibility to move the sensor. Lower power Bluetooth allows the batteries to last for multiple years, and software can alert when power is low. Vibration is a common example.

Modern Tools for Predictive Maintenance

Vendors in the industrial space have begun to leverage commercial IoT technologies and software-centric platforms to deliver smart factory solutions. You can expect to see an increasing number of consumer-grade connectivity features deployed to manufacturing plants. Digital transformation programs are a journey, so the technology platforms you select need to be complete enough or open enough to meet your needs now and in the future. InsightCM from National Instruments is an example of the technology referenced in this brief. The software-centric platform provides open access to data and connectivity to 3rd party software, such as historian databases and advanced pattern recognition tools now being adopted used by maintenance teams.



Example platform – InsightCM - that uses IoT technologies including edge processing, MEMS sensors, BLE5 wireless communication, and cloud/server/client connectivity protocols

Source: National Instruments

Project Selection Guidance

Should the initial project be a proof of concept on a non-critical asset or an essential asset that has been problematic? The key problem with choosing the low-risk proof-of-concept path is that few will take it seriously. This means that the PdM project will be given limited resources and management attention. Success will likely not make management’s radar screen.

To get the resources and organizational cooperation to be successful, start with an essential asset where unplanned downtime caused lost production. Preventing lost production will get support from operations and production personnel. Preventing equipment failures that negatively impacted revenue will get management attention and support.

Consider instances where a relatively inexpensive component failure cascades into an expensive, catastrophic outage. Identifying the issue in the component before it fails provides huge savings in repair cost, downtime, and MTTR. Examples might include:

- A fracture in the blade of a gas turbine can cause blade failure that impacts all downstream blades and “corn cobs” the rotor
- In a power distribution substation, a transformer failure can lead to a fire that propagates into other transformers

Conclusion

Consider this: What does your CEO care most about? The priority is revenue to fund the business. The focus is the P&L statement and driving shareholder value. A likely close second involves the financial ratios for assets in the balance sheet which also helps improve shareholder value.

What is not a priority? The number of maintenance technicians on staff. Unfortunately, most project justifications focus on maintenance labor costs. This narrow view fails to get executive attention and often suffers from a lack of resources. While the benefits to production and maintenance should be included to broaden organizational support, they should not be the focus.

To gain executive attention, support, and adequate funding for successful predictive maintenance projects:

- Focus justification on C-suite KPIs and ROA, i.e., the revenue gains and cash conservation obtained by reducing downtime on essential assets needed to make product and realize sales
- Control project cost and risk with packaged application software and wireless sensors

With this approach, you can obtain positive executive attention for your project and yourself, advancing your credibility and your career.

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