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Assessing Factory Readiness for Predictive Maintenance

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Introduction

Predictive Maintenance ("PdM") is a transformative approach to industrial asset management, enabling organizations to reduce downtime, improve productivity, and extend the lifespan of machinery. However, failed implementations happen on occasion, often as a result of inadequate preparation, misconceptions of what is required for success, or a failure to recognize that PdM is not just a technology but an approach that encompasses people, processes and technology. This white paper provides a comprehensive guide on how to assess whether you are ready to adopt predictive maintenance. It outlines key areas to investigate, steps to assess readiness, and best practices to ensure a successful transition to this modern, data-driven maintenance strategy.

Why Predictive Maintenance?

PdM leverages data analytics, predictive equipment models, machine learning, and IoT technologies to predict equipment failures before they occur. By proactively addressing issues, organizations can avoid costly downtime and maintenance activities, making it a compelling option for factories seeking to optimize their operations.

A properly executed deployment of predictive maintenance can generate millions of dollars of financial value per year for a modest-size factory, while reducing safety and environmental risks. There's a reason the majority of modern operators are all deploying PdM.

The Anatomy of an Assessment

Before jumping in, it is crucial to understand the key elements that determine a factory's readiness for predictive maintenance:

1. Business Goals & Objectives

The assessment starts and ends with the business objectives. Knowing what metrics to improve and setting goals for achieving them can center your team when evaluating areas for predictive maintenance

2. Machine Criticality

Not all machines in your factory are of equal importance to productivity or safety. Which assets are critical? Understanding what machines expose your operations to unplanned production stoppages is key, as is knowing if there are "bad actor" machines that frequently cause problems.

3. Do you FMECA?

Each machine class has different dominant fault modes, and the process or usage of each machine impacts how common each of them will be for each machine. The gold standard here is to have full Failure Mode, Effect, and Criticality Analyses conducted for each critical machine in your plant.

Failure Modes, Effects and Criticality Analysis

Component	Potential Failure Mode	Severity	Potential Causes	Occurence	Process Controls (Detection)	Detection-i	RPN-i	Detection with PHM	Detection-r	RPN-r	RPN Delta
Valve Plate	Leakage	7	Fatigue from high impact	8	Vibration analyzer	6	336	Pressure monitoring Temperature monitoring Valve plate fatigue prediction	2	112	224
			Wear from impact with the valve seat or plate	8	Vibration analyzer	5	280	Pressure monitoring Temperature monitoring Valve plate wear prediction	2	112	168
			Wear from abrasives in the process	5	Process output	8	280	Pressure monitoring Temperature monitoring Valve plate wear prediction	2	70	210
			Chemical corrosion	5	Process output	8	280	Pressure monitoring Temperature monitoring Valve plate corrosion prediction	2	70	210
Valve Seat	Leakage	7	Wear from valve plate impact	8	Vibration analyzer	5	280	Pressure monitoring Temperature monitoring Valve seat wear prediction	2	112	168
			Chemical corrosion	5	Process output	8	280	Temperature monitoring Pressure monitoring Corrosion prediction	2	70	210
			Wear from abrasives in the process	5	Process output	8	280	Pressure monitoring Temperature monitoring Valve seat wear prediction	2	70	210

4. Data Availability, Quality and Relevance

The cornerstone of predictive maintenance is data, which needs to be both accessible and relevant. Assess the availability, quality, and relevance of data from sensors, historical maintenance records, and other relevant sources. Ensure data collection is consistent and covers critical assets with appropriate sensing technology, including the right sampling frequencies.

5. Technology Infrastructure

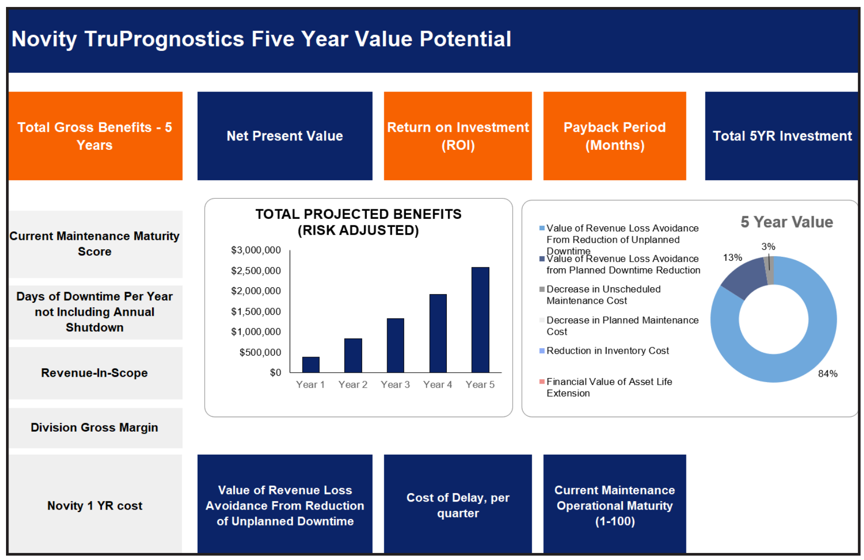
Evaluate the factory's existing technology infrastructure, including connectivity, availability of relevant IoT sensors, data storage, processing capabilities, cloud readiness, and cybersecurity maturity. Does the maintenance staff have access to mobile devices? Robust IT infrastructure is essential for predictive maintenance.

8. The True Cost of Downtime

Understand the true costs of unplanned downtime. This analysis needs to include both direct and indirect costs and is in most cases dominated by lost profits resulting from products not made. Important considerations here include whether your plant revenue is limited by sales or by production, and whether downtime events result in costly overtime pay.

In addition to increased output, organizations also often see radically improved maintenance cost performance, with maintenance costs reduced by 10% compared to preventative maintenance[2] and a whopping 40% reduced compared to reactive maintenance[3]

The true cost of unplanned downtime, is on average 11% of the annual yearly revenue for manufacturers.[1]



6. Maintenance Practices

Assess the current maintenance practices in place. Identify areas where predictive maintenance can complement or replace existing preventive or reactive strategies.

7. Workforce Skills

Determine the skill level of the workforce. Training and upskilling may be required to operate and maintain predictive maintenance systems effectively.

9. Budget and Resources

Consider the budget and resources required for implementing and maintaining predictive maintenance solutions. Ensure alignment with organizational goals and that appropriate resources are committed to making the venture a success.

1 Source: Siemens; 2 Source: US DOE; 3 Source: Deloitte

Steps to Assess PdM Readiness

The ultimate objective of the PdM readiness assessment is to understand how to deliver a solution that's configured to your operations. Ideally, this solution should take advantage of what you have already built to maximize the ROI. Your process may be different, but most organizations go through some version of the following process steps to achieve that objective:

Step 1: Operations Assessment

- Identify critical assets that would benefit from predictive maintenance; review FMECA if available and ensure you know what failure modes are important to predict for each asset.
- Calculate the true cost of downtime and maintenance for these key assets and for the plant as a whole.

Step 2: Data Audit

- Identify the types of sensors and data sources available and their performance level[4]. These data sources can include:
    - HMI, SCADA, DCS, Data Historian, CMMS, EAM, LIMS, etc.
    - Maintenance Logs, Equipment Upgrade Records, Parts Usage, Error Reports
    - IoT Sensors
- Evaluate data collection methods and frequency.
- Check for gaps or inconsistencies in historical maintenance data.
- Perform a gap analysis, comparing sensor data availability to what's required for critical fault mode observability, as revealed in the Operations Assessment[5].

Step 3: Infrastructure Assessment

Evaluate the factory's technology infrastructure to ensure it can support predictive maintenance:

- Examine the network connectivity and reliability.
- Assess the capacity of data storage and processing systems.
- Determine the compatibility of existing systems with predictive maintenance software.

Determine whether cloud access to enterprise data is feasible[6]

Step 4: Maintenance Ops Maturity Assessment

Analyze the current maintenance processes and identify opportunities for improvement.

- Review maintenance schedules and practices.
- Identify gaps in technical skills related to predictive maintenance.
- Develop a training plan to bridge these gaps.
- Assess data governance policies.

Step 5: Cost-Benefit Analysis

Perform a cost-benefit analysis to determine the financial feasibility of adopting predictive maintenance:

- Estimate the costs of implementing predictive maintenance technology, both upfront and ongoing costs.
- Calculate the potential savings from reduced downtime and maintenance costs, how much of the true costs of unplanned downtime can realistically be addressed by PdM? How much Qualified Unplanned Downtime is there?
- Compare the ROI with other maintenance strategies or with continuing with business as usual.

4 Sensor frequency is critical, as some failure precursors are only visible with high-frequency sensors.; 5 For instance, if pump cavitation is a key fault mode, are there flow sensors installed that enable their detection?; 6 On-premise installations usually come with significant cost and management drawbacks. In evaluating this, it's important to understand how to connect (e.g. via Kepware, OPC-UA, etc.) and whether there are firewall or other security restrictions that need to be understood.

How Do You Get Started?

Every journey begins with a first step. Moving to predictive maintenance can be a big step, but there are several best practices to make the journey faster:

1. Create Your Team

Form a cross-functional tiger team consisting of maintenance personnel, operations team members, data scientists or modelers, IT professionals, and management to ensure a comprehensive assessment. This team can include vendors.

2. Define Success

It is exceptionally important that you know what success looks like before you start the first deployment. What metrics are you trying to impact? How do you measure that success? How many data points do you need to conclude an evaluation? Organizations care about a variety of metrics, including OEE, total amount of unplanned downtime, % of maintenance work being reactive, and others.

3. First Project

While it is prudent to walk before you run, you should resist the temptation to "start small" with a "proof of concept" or a "pilot". With too few assets under a PdM project, the risk is that you won't get sufficient information to make a well-informed decision about a wider roll-out, delaying what can be a very valuable capability for much longer than what is necessary. Instead, start with a real but limited deployment and start using it operationally right away. Only a real deployment will provide a real test and ensure that all involved stakeholders are fully motivated to make it a success.

4. Continuous Improvement

Recognize that factory readiness is not a one-time assessment. Continuously monitor and adapt to changes in technology and business needs.

To learn more about how Novity can assist in completing your assessment, schedule a time to talk with the survey team today: info@novity.us novity®

About Novity

Novity provides truly predictive asset life, leading to the best path to Zero Unplanned Downtime. Using IoT sensors, pre-built physics models of machine faults, and sophisticated machine learning, we provide exceptionally accurate Remaining Useful Life predictions. Because of this unique approach, we can deliver high-performance solutions even in environments with little historical data.

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