Artificial Intelligence: Predictive Maintenance Business Case

Adopting a predictive maintenance project aims to reduce the cost of maintenance, by permitting you to stave off unforeseen breakdowns, minimize the frequency of checkups, group maintenance activities, perform focused maintenance, optimize maintenance cycle times, and procurement of spare parts "on-demand" or pass over expected maintenance activities.

A simplistic view of predictive maintenance is about avoiding: that you stop the production process (customer delay, canceled orders, wasting product, and missing revenues), hire premium skilled maintenance technicians, and order spare parts with emergency shipping.

But in reality, the whole organization will benefit from the predictive technology insight into the current and future state of assets and processes which can also benefit other stakeholders in the organization, such as the production department—by reducing energy and materials usage, increasing availability, reducing slowdowns, and reducing quality losses—and the project department—by extending assets' useful life and utilization.

In this article, we will cover some value drivers for predictive asset maintenance and a guide to help you identify the use case and assess the business case.

The Value of Predictive Maintenance

Using modern AI technology solutions for predictive maintenance allows an organization to take proactive actions, such as performing targeted maintenance, scheduling maintenance activities, and services teams, and planning asset usage. However, those actions require a tremendous effort of coordination.

In reality, most organizations have a certain minimum response time (the time required to respond to a request for action). The earlier you know an asset requires intervention, the larger the range of actions you can take. The savings are generated by helping the organization to switch toward its optimal response time.

While evaluating the business case for applying a new predictive maintenance technology, it is important to consider that by definition its accuracy is never going to be perfect but significantly better than classic scheduling. Notably, for complex assets with multiple failure modes and degradation mechanisms, a business case investigation should cover the likelihood of lacking an imminent failure and the likelihood of getting a false alarm as well.

In addition, it should be noted that for many assets, the accuracy before implementing a new AI-powered predictive maintenance technology is rarely zero. Anomalies and probable breakdowns can, for example, be noticed during visual inspections, functional checks, and via production disruptions, although the forecast margin of these methods is generally lower than with predictive maintenance technologies. Sound business cases, therefore, focus on the difference in accuracy between the old and new approaches and situations.

Even under conditions of uncertainty five important factors are to be considered when thinking about the value added by predictive maintenance:

1. Understanding Asset Criticality

2. Infrastructure Requirements

3. Time Savings

4. User Adoption

5. Data Management

The main challenges when implementing predictive maintenance include:

- Ignoring how to do predictive maintenance
- Missing AI training data to build suitable predictive maintenance systems
- Lacking disruption data to achieve accuracy and proper service case classifications

Methods for Assessing the Business Case for Predictive Maintenance

Beyond the maintenance department, AI-Powered Predictive Maintenance can drive meaningful benefits for other stakeholders which makes it an extremely complicated task to assess its business case.

There are several ways of assessing the business case, in the present article, we will cover the two major ones.

1. ROI:

The return on investment depends on the difference in costs and gains between the present state and the future state.

The costs of predictive maintenance can be segregated into preliminary and recurring costs (CAPEX and OPEX). Initial costs are incurred to implement the new system, such as costs for engineering, procurement, installation, and on-site training. Recurring costs are those incurred by the system's ongoing use: for example, the costs of inspections, analysis, data dithering, software as a Service (SaaS), and management. If these activities are outsourced, the recurring costs will be aggregated on a monthly or yearly basis.

In a business case, the most obvious part to identify is usually the costs, as they are either speculated by the provider of the predictive maintenance technology or service or reclaimed from previous use cases.

The major challenge is to quantify the benefits of predictive maintenance. This is where a lot of uncertainty comes in: you don't know how many times an asset will break down, how effective the predictive maintenance technology will be if any changes will be implemented to prolong the lifetime of the asset, how much revenue shortfall the AI is going to help prevent.

To make it less complex and reduce estimation bias, the simplest way is to: classify the asset failure into failure modes. If an asset has 20 ways of failing, write them all down, and assess for each failure mode whether the predictive maintenance technology will improve the sensitivity.

If so, for that failure mode, then estimate the current cost and the new cost using the predictive maintenance system. The cost is the difference between the minimum response time and the optimal response time that can be used.

To simplify the matter, you need to estimate the costs for two scenarios:

(a) the failure was not foreseen,

(b) the failure was foreseen.

Include whatever costs are relevant for your case and asset class: the costs of maintenance, the opportunity costs of lost production and revenue shortfall, the costs of environmental damage, regulatory penalty payments, and so on.

After that, discern the additional value you will gain from the new predictive maintenance system. To what extent and how will it affect inspection costs, periodic maintenance costs, operational costs, operational revenues, and so on?

Calculate the resulting benefit separately for each source of value. Common sources of value are:

- Reducing the frequency of other inspections, if the new technology replaces visual inspections partly or altogether.

- Stretch the intervals of scheduled maintenance, if routine maintenance is skipped while the predictive maintenance system indicates that the asset state is still correct, or if regular maintenance is fully stopped.

- Reducing energy usage, if the new system helps you identify and solve energy wastage earlier.

- Prolong the lifetime of the asset, if the deterioration is identified and fixed at an earlier stage, avoiding any further damage, or if the new technology permits to identify the origin of the degradation and to minimize it.

Additionally, you need to add the cost of alarms, which in some cases very complicated task involving several departments including HR; the cost of alarms (both true and false). How many alarms do you expect each day/ month/year? And how will you respond to them? Write down the process and identify the direct and indirect costs. Food for thought, it's common for sensors to trigger an additional inspection, either to validate the alarm or to diagnose what maintenance needs to be performed.

Return on Invest – The Payback Period

If the organization is interested in the payback period of the investment, Time is our major factor. Let's assume an organization is willing to invest in an asset only if the asset has a payback period of fewer than three years.

A simulation is an imitation of a process or system—such as an asset's maintenance process—over time. By creating a simulation model for an asset or group of assets, it becomes possible to observe what is likely to happen in the future. The future is uncertain, yet some scenarios are more likely than others. By running a simulation repeatedly (a thousand times, for example), you can generate a probability distribution for each outcome.

The question then becomes: of these one thousand simulated, how many of them had a payback period shorter than three years

Once the basic structure has been developed, it becomes relatively easy to increase the number of assets, especially if the assets and their maintenance processes are similar to each other: they have the same failure rate, similar consequences of failure, similar costs of maintenance, and so forth.

So, when are simulations a good way to go?

- If the decision is very important.

- If timing matters.
- If the system is complex (for example, when variables are interrelated).
- If you're interested in getting more detailed insight into the system.
- If the number of similar assets is medium (more items mean less chance of bias, the thing you're trying to eliminate through simulation).

As the global market and adoption of AI continue to grow, many companies are turning their operations to Edge AI technology because of its relevant advantages over cloud solutions, such as total cyber security and internet independence.

Implementing AI solutions for predictive maintenance may be beneficial for the whole organization since it affects other stakeholders beyond the maintenance and the production departments but assessing its business case can be a complex task.

We hope the insights we've shared here will help you assess the business case for predictive maintenance in your own company. For more information, you could request an appointment to discuss with an expert and have tailored advice for your business case.

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