Winning the race against time

Assessing the value of predictive maintenance against downtime

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Unplanned stoppages caused by equipment failure are one of the biggest challenges in manufacturing. Fighting downtime is a leitmotiv of trade literature, and has recently been a core area of focus at Hannover Messe, possibly the most famous trade show for industrial automation and Industry 4.0 solutions.

There are many solutions on the market to improve the status quo using information from big data, smart sensors and AI-based condition monitoring. However, it can be difficult to know where to start.

This guide offers a comprehensive overview of how downtime impacts business' bottom lines, how to calculate the known and hidden costs of downtime, and how to evaluate the feasibility and return on investment (ROI) of a predictive maintenance programme. Finally, manufacturers will find tips on how to gradually implement a predictive maintenance strategy, without revolutionising their existing processes and factory layout.

The cost of downtime

A business' true downtime cost (TDC) is the sum of all costs sustained while production is on hold, as well as the resources needed to find and fix the cause of the problem.

According to recent research by Senseye, unplanned downtime represents one of the major causes of lost revenue in manufacturing worldwide, with an average of eight per cent of annual revenues lost as a result of equipment failure.

The Manufacturer also highlighted that a lack of reliable data from equipment is currently penalising the manufacturing sector, leading to the inability to detect issues early on, and consequently to poor decision-making from plant managers and maintenance personnel.

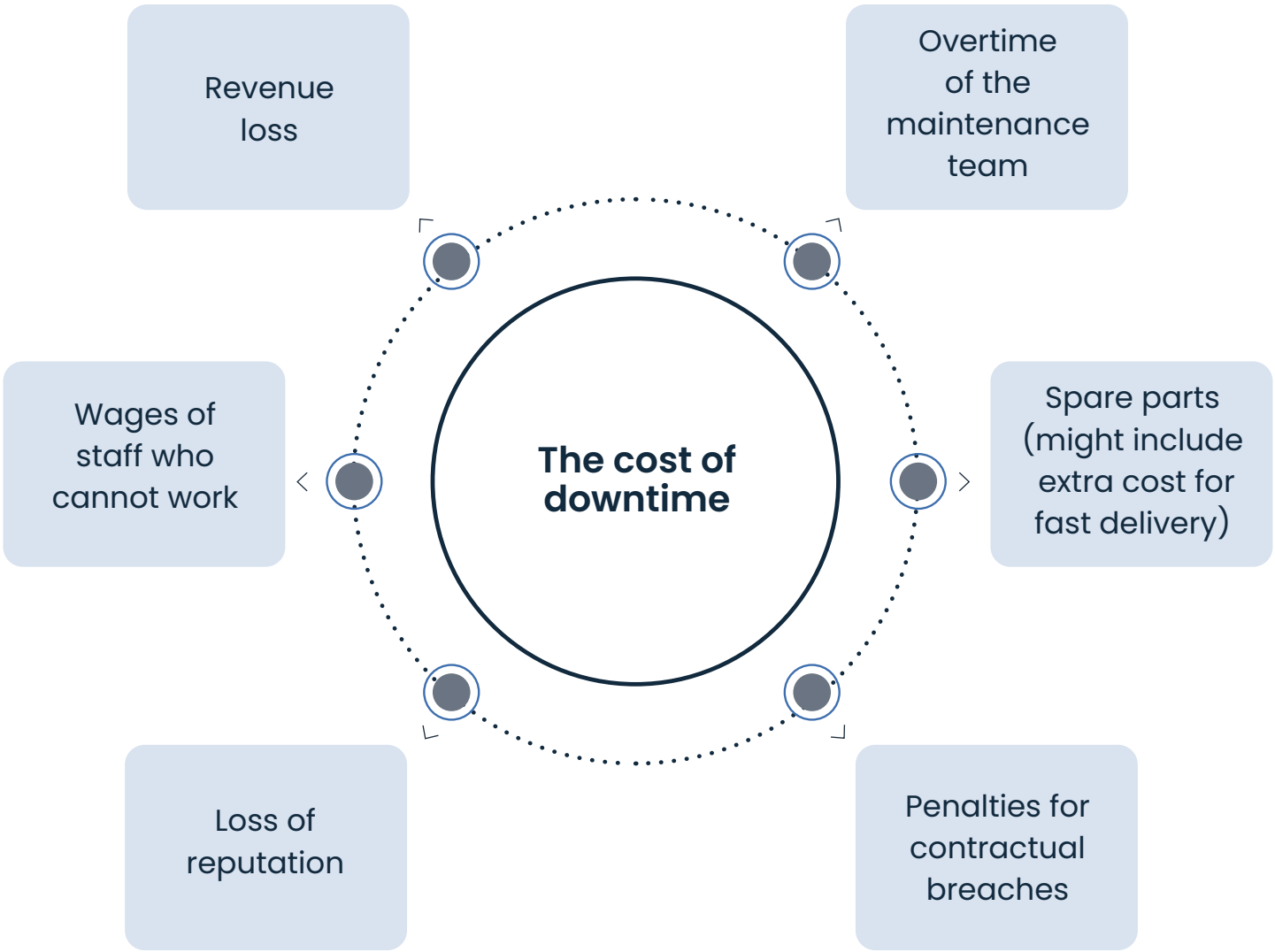
The figures below paint an exact — and worrying — picture of the cost of downtime in manufacturing, and of all the elements that make up these figures.

Average cost of downtime for large firms in the manufacturing and industrial sectors.

$532,000
a year

$9,000
a minute

$148
a second


Revenue loss
Overtime of the maintenance team
Wages of staff who cannot work
The cost of downtime
Spare parts (might include extra cost for fast delivery)
Loss of reputation
Penalties for contractual breaches

Prevent or predict?

To minimise the cost of downtime, manufacturers need to implement a proactive maintenance strategy that tackles problems before they lead to catastrophic equipment failure. Both preventative maintenance and predictive maintenance are designed with this goal in mind, and both are drastically superior to reactive maintenance in terms of cost and time savings. However, there are substantial differences between these two approaches.

Preventative maintenance programmes rely on interventions that are carried on at regular intervals, the frequency of which is usually determined based on the type of equipment to be maintained, the application, and historical data about the probability of failure.

Compared to emergency repairs, preventative maintenance offers many advantages — machines are not run to failure, downtime caused by equipment malfunctions is reduced, and the maintenance team can rely on a well-established routine for checks.

However, planned maintenance inevitably leads to over-maintenance costs. This is because maintenance engineers tend to build an error margin into the maintenance plan to be on the safe side and avoid waiting too long for scheduled checks.

For example, most sealed bearings will last from five to seven years. Replacing a bearing can take from 30 minutes to two hours, and any industrial site has hundreds if not thousands of bearings. Considering the cost of the bearings themselves and the wages of the maintenance team, the difference between five and seven years can determine a huge additional cost for the plant.

If the maintenance engineers decide to replace all bearings every five years instead of every seven, this will translate into a massive additional cost for the plant. Instead, monitoring equipment 24/7 with smart sensors can give a more precise indication of when bearings — and other automation parts — need to be replaced, ensuring that manufacturers capitalise on the full active lifespan of their equipment.

Benefit	Preventative	Predictive
Minimising downtime	✓	✓
Prolonging equipment lifespan	✓	✓
Allowing for timely order of spare parts	✓	✓
Energy saving	✓	✓

Benefit	Preventative	Predictive
Eliminating the costs of over-maintenance	✗	✓
Flagging problems in-between checks	✗	✓
Monitoring equipment 24/7	✗	✓
Low cost of implementation	✓	✗
Fast to learn	✓	✗

However, predictive maintenance relies on gathering real-time data from machinery and using it to determine the health state of the OT system.

Sensors — collect data that provide useful information on the health state of a machine (temperature, vibration levels, noise, pressure etc)

Internet of Things (IoT) — translates the information into digital signals and ensures that they are transferred to a centralised system for analysis

Machine learning (ML) and artificial intelligence (AI) — browse data to spot unusual machine behaviour that might indicate imminent failure

Human-machine interfaces (HMIs) — allow technicians to have full visibility of complex interconnected systems, both on site and remotely.

The cost of predictive maintenance

There's no denying that predictive maintenance, compared to a planned maintenance approach, involves more set-up costs as well as a steep learning curve for personnel. However, the good news is that these costs might be lower than manufacturers think and might lead to a high return on investment (ROI) in the long run.

For example, temperature sensors can cost around $100, but can be invaluable in preventing the overheating of more expensive pieces of equipment that are critical for the smooth operations of the factory, such as electric motors. Vibration sensors can go up to $1,000, but they enable vibration analysis — one of the most used and effective forms of condition monitoring — on a wide variety of rotating equipment, such as motors, gearboxes, fans and more.

These low-cost sensors can also be retrofitted on existing legacy machines that do not have built-in communication capabilities. This allows plant managers to move towards Industry 4.0 without having to commission an expensive and unnecessary factory overhaul. This strategy also allows smaller manufacturers to gradually implement predictive maintenance, starting with the most important pieces of equipment and progressing to less critical machines as needed.

Another expense to consider is the software to gather and process data from sensors. Subscriptions to a computerised maintenance management system (CMMS) start at about $400/year per user, while data analytics tools to gather and analyse data start at about $200/year per user.

Manufacturers should also calculate the loss of productivity and the wages of employees that are busy learning how to operate and maintain the predictive maintenance system. Training in this field can have a relatively steep learning curve, and external experts might be needed to train personnel.

Nevertheless, if we compare these costs to the costs of hourly downtime outlined above, it's easy to see that predictive maintenance adds tremendous value.

So, should every manufacturer rush to implement a predictive maintenance programme? Not necessarily. If the costs of setup and deployment are greater than the cost of downtime, then preventative or even reactive maintenance could be the right strategy. So, how to evaluate?

Seven steps to predictive maintenance

1. Calculate the average cost of downtime in your facility. Sum up all the elements outlined in the chart above, including revenue loss, wages, the cost of parts and the risk of breaching contracts. This should give you a rough estimate of how much an hour of downtime is costing you.

2. Be aware of the frequency of unplanned downtime occurrences in your facility. This will help you understand the annual impact of downtime to your bottom line.

3. Pinpoint the most critical pieces of equipment — those that would benefit the most from predictive maintenance. Start small and add more elements as needed.

4. Calculate the average cost of a predictive maintenance programme for critical equipment. Including sensors, software, training, and the wages of employees that will be learning how to implement and operate the new system.

5. Evaluate how fast the ROI of your predictive maintenance programme would be, based on the data on the cost of downtime you gathered in step 1.

6. Evaluate whether you can drive costs down by using reconditioned rather than new hardware. Use EU Automation's free Knowledge Hub for extra guidance and training.

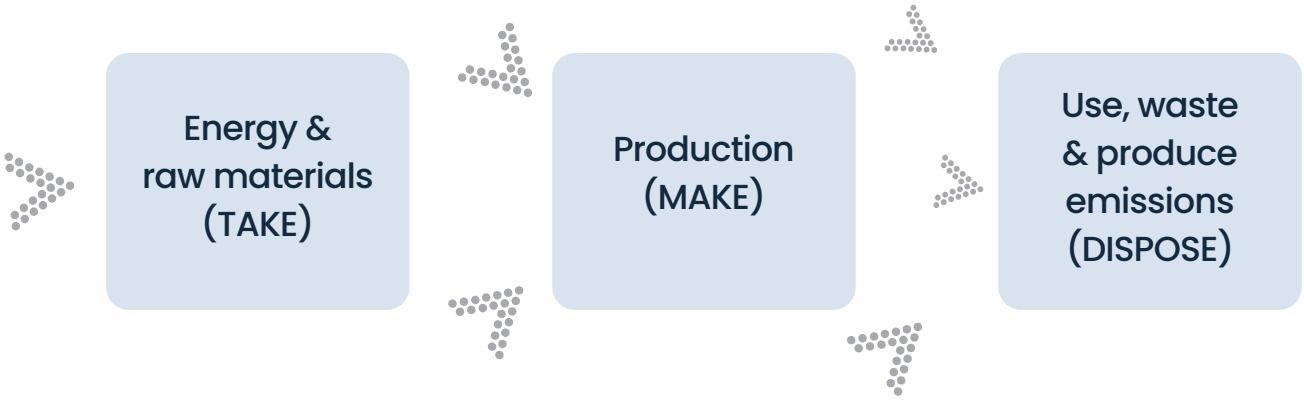
7. Is the ROI in line with your expectations? If so, predictive maintenance is for you. If not, preventative or reactive maintenance might be the best choice for now.

The added value of sustainability

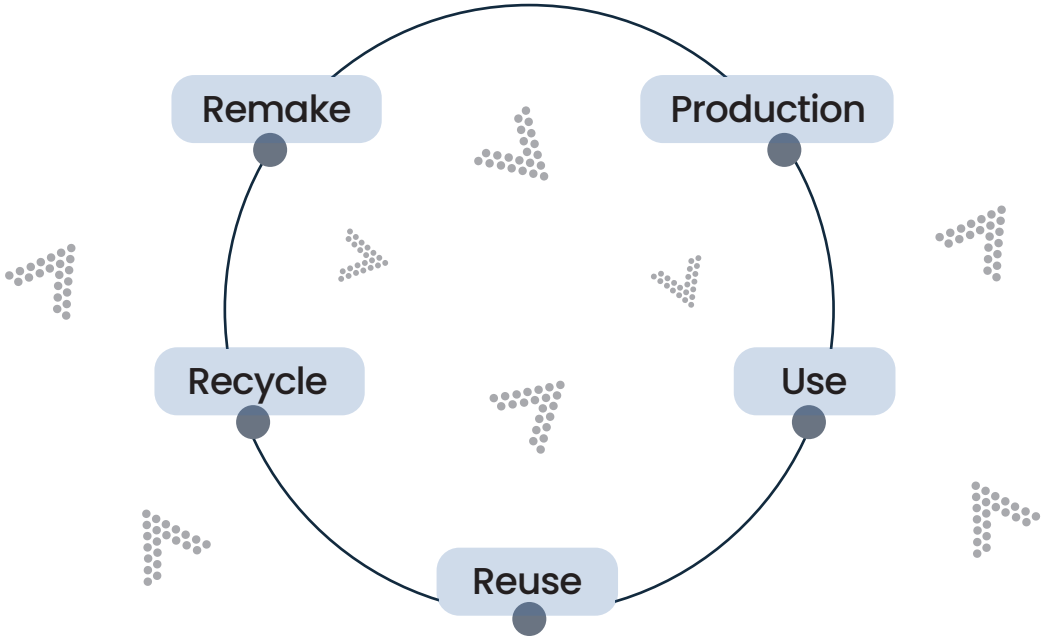
Hannover Messe, SPS Italia and several more trade shows all had one point in common in 2022 — the focus on sustainability.

In particular, Hannover Messe highlighted the importance of moving from a lineal to a circular manufacturing model. In 2021, on July 29, Earth Overshoot Day, humanity had already consumed more resources than the Earth can replenish in a year. To improve these concerning figures, drastic changes are needed.

Linear Economy



Circular economy



This shift must involve maintenance too.

Implement predictive maintenance to replace equipment and its components only when needed, thus reducing the amount of waste and e-waste ending up in landfills.

Prefer reconditioned spare parts over new ones — make sure to order from a reliable supplier who can provide fully reconditioned, cleaned and tested parts that perform as new. EU Automation also offers a 12-month warranty on all parts for extra peace of mind.

Manage obsolescence proactively — be aware of the active lifespan of your legacy equipment and liaise with a supplier that specialises in obsolete spare parts, like EU Automation, to order components that are no longer available from the original equipment manufacturer (OEM).

Find additional resources in EU Automation's Circular Economy Knowledge Hub.

Conclusions

To gain a competitive edge, is it critical that manufacturers are fully aware of how downtime is impacting their business' profitability. Solutions to mitigate the consequences of downtime might be less expensive and complex than manufacturers realise, and a short trial on a couple of critical pieces of equipment can be a good way of testing whether predictive maintenance is likely to be a smart investment.

EU Automation is available to assist manufacturers at all stages of their maintenance programmes, whether they want to order smart sensors for condition monitoring, or require the speedy delivery of automation parts for emergency or planned repairs. Contact us today for a free quote.

www.euautomation.com/en/knowledge-hub

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