Manufacturers ALLIANCE FOUNDATION

IN PARTNERSHIP WITH

ATS
Advanced Technology Services, Inc.

Predictive Maintenance Strategies Gain Ground

Leaders move to capture productivity gains and data-savvy talent

2022

Executive Summary

Predictive maintenance (PdM) has proven itself in terms of productivity and ROI, especially in the demand-driven, high-growth environment of 2022. But adoption is being held back by the skilled talent shortage as well as outdated systems and thinking. Successful predictive maintenance deployments focus as much on the technology as they do on new strategies for upskilling, recruiting, and change management.

To connect manufacturing leaders with best practices to embrace and pitfalls to avoid, Manufacturers Alliance, in partnership with **Advanced Technology Services, Inc. (ATS)**, recently conducted in-depth research with companies in the product and process industries. While progress is slower than respondents would like, bringing maintenance into the digital age is on everybody's roadmap. Recommendations for action include specific steps that leaders can take to create buy-in, build skills and bench strength, and bridge maintenance strategies to competitive advantage and profitable growth.

Key Findings

- Manufacturers see value in PdM strategies (uptime, productivity, quality) and most experience a rapid return on investment. At the same time many struggle to move beyond the pilot phase.
- Adoption is being held back in many cases by talent shortages and changing talent needs. Most companies expect deployment of PdM technologies to increase their need for advanced analytics skill sets. They plan to retain, upskill and redeploy current maintenance staff into other areas of operations, such as continuous improvement activities.
- Outsourcing can provide the means to tap into expert communities quickly, when onsite staff experiences a problem that is novel to them. This approach reduces the dependency on local teams and helps accelerate root cause analysis.
- Change management and training programs go hand-in-hand with adoption of PdM strategies. Shifting to a culture which relies on trusting the data can be a slow process for some companies.
- PdM technologies are becoming smarter and more feature-rich every day. As adoption expands, so will the body of knowledge that helps companies improve uptime, productivity and quality.

Continue on to learn more about PdM strategies and read first-hand accounts from companies at all stages of deployment including their challenges, successes and suggestions getting started and staying on track.

Introduction

In today's demand-driven, talent-constrained world, manufacturers are on the lookout for operational improvements to help them drive profitable growth. One space that is getting more attention is maintenance strategy, specifically the evolution from reactive maintenance approaches to data-intensive predictive maintenance strategies. But many manufacturers, while convinced that predictive maintenance is the right goal, are struggling to gain traction and scale up from isolated pilot projects.

To better assess the situation, Manufacturers Alliance recently conducted in-depth research with mid- to large manufacturing companies to gain a more nuanced understanding of benefits and best practices leveraged by the most mature companies as well as challenges and roadblocks encountered by those that are stalled. We surveyed 170 companies representing both product and process industries and interviewed subject matter experts from an array of manufacturing companies.

Our top-level findings revealed robust agreement among respondents that predictive maintenance solutions offer clear value with a rapid return on investment. At the same time, they told us that enterprise-wide deployment of predictive maintenance is hampered by the skills gap, deficiencies in data, ambiguous organizational ownership, and uncertainty about how to formulate the business case for adoption.

Core benefits of predictive maintenance ranked by priority

While progress is slower than respondents would like, the desire to bring maintenance into the digital age is ubiquitous. This is especially true now as companies struggle with high backlogs and production-constrained growth. As one panelist quipped, "Our customers are waiting, and the lines have got to run!"

There is good news. The enabling technology is constantly evolving – getting smarter and more feature-rich by the day. For that and other reasons, moving to wider deployment of predictive maintenance for most companies is not a matter of if, but when.

Maintenance Phases

1. **Reactive**
   Fix when broken
2. **Planned**
   Schedule maintenance activities
3. **Proactive**
   Defect elimination to improve performance
4. **Predictive**
   Advanced analytics and sensing data to predict machine reliability

Adopting Predictive Maintenance – Different Paths, Same Destination

Finding your way out of pilot purgatory

Maintenance strategies vary widely across companies. For one business, the old-fashioned reactive (fix it when it breaks) approach may make perfect sense. For another, where assets are expensive and critical to operations, more advanced maintenance strategies are becoming more commonplace. Even within companies, there may be a wide disparity between approaches from one location to another depending on an individual facility's budget, cost of its assets, and criticality of those assets to operations. "We have sites with reactive approaches as well as sites with world-class predictive maintenance systems and everything in between," one respondent told us. This is especially true of companies that have grown through acquisitions.

Global sensor, software, and autonomous solution provider **Hexagon's** approach has been to focus predictive maintenance solutions on "particular factories and kinds of equipment," according to Will Durfee, VP of Global Operations at Hexagon. "It's on the most critical operations that we have, and places with capacity constraints right now, where we want to utilize every minute of uptime of the machines," he added.

Wherever companies fall on the maintenance continuum, increasing uptime is the ultimate goal. "Reducing breakdown losses relates to uptime improvement, and that has been, and continues to be, our objective for most of our predictive tools," said Andrea White, Vice President of Global Operational Excellence at **Sonoco**, a global provider of consumer, industrial, healthcare, and protective packaging.

Many companies have initiated PdM pilot programs to gain experience and test solutions. **ELLWOOD**, a global supplier of quality metals and custom-engineered components for essential applications, had a strong preventative maintenance regime in place for years and launched a sensor-based predictive maintenance pilot program, focusing on the most critical assets. Bishwajit Ranjan, Director of Plant Services at ELLWOOD's Houston Forge, told us about his successful move from PdM pilot to roll-out: "About three years ago, we started with a pilot program covering a small subgroup of assets because we didn't want to invest a lot before determining the advantages. We started with about six sensors. Last year, we completed the pilot phase and now have extended our sensor-based PdM to nearly 60% of our most critical assets."

> **"Last year, we completed the pilot phase and now have extended our sensor-based PdM to nearly 60% of our most critical assets."**
>
> **— Bishwajit Ranjan, ELLWOOD**

Ask an expert, if you can find one

Advancing from pilot to widescale deployment still eludes many manufacturers. The most frequently cited roadblock was centered on talent — specifically that employees lack the technical skills to work with data. Not only do organizations lack data-savvy talent, they also have concerns that their internal data may be incomplete or unreliable. Some lack the ability to store or retrieve historical data.

Prioritizing that data is also a key factor. Dr. Benjamin Baumann, Digital Product Manager at **John Deere**, shared the two considerations most important from his point of view: "What is the right data to look at and what is the right frequency to collect it – every second, every tenth millisecond? If I take all the data that a CNC machine creates today, stream it into the cloud and run it through an AI algorithm, I can easily have petabytes of data within a day. So that's not the solution." A data lake can quickly become a data tsunami swamping decisionmakers.

Micah Statler, Director of Operations at **ATS**, which specializes in industrial maintenance and technology services, recommends that companies just getting started should focus on two parameters, such as vibration and temperature, and then layer in additional ones, if and when the need arises. This approach helps teams early in their predictive maintenance journey avoid the data deluge while also providing them with actionable information.

Another roadblock is unclear ownership. In many cases, organizational models haven't been worked out yet, and this is slowing down PdM adoption. Each location is operating independently and collecting data on a different platform. These can be difficult to rein in and standardize. "Years ago, when we first started, we had to back up and say, hey, we don't even have the data coming into one platform to analyze it right now," Andrea White of Sonoco told us. Another expert noted that "plants are independently looking into solutions and programs and even setting them up." The problem of scattered, unmatched data sets being generated by different brands and generations of automation equipment is even more pronounced in companies that have recently grown through acquisitions.

Uncertainty about how to make the business case for starting or scaling up a predictive maintenance regime is stopping many leaders. As one operations professional told us, the problem is two-fold: not having a clear understanding of the business case and not knowing how to articulate it. Erin Welken, Director of Operations Excellence and Digital Manufacturing at **Johnson Controls**, has observed exactly this phenomenon in various roles over the years helping units get started. As she explained, "There's a lot of information. Salespeople contact you constantly. It can create analysis paralysis where you're not sure what to

"If I take all the data that a CNC machine creates today, stream it into the cloud and run it through an AI algorithm, I can easily have petabytes of data within a day. So that's not the solution."

— Dr. Benjamin Baumann, John Deere

do or which solution will truly meet your needs, easily, at the best cost. I don't believe it is always about the money. The largest gap seems to be the lack of knowledge and the insecurity people experience around 'am I going to be able to make the right decision?'"

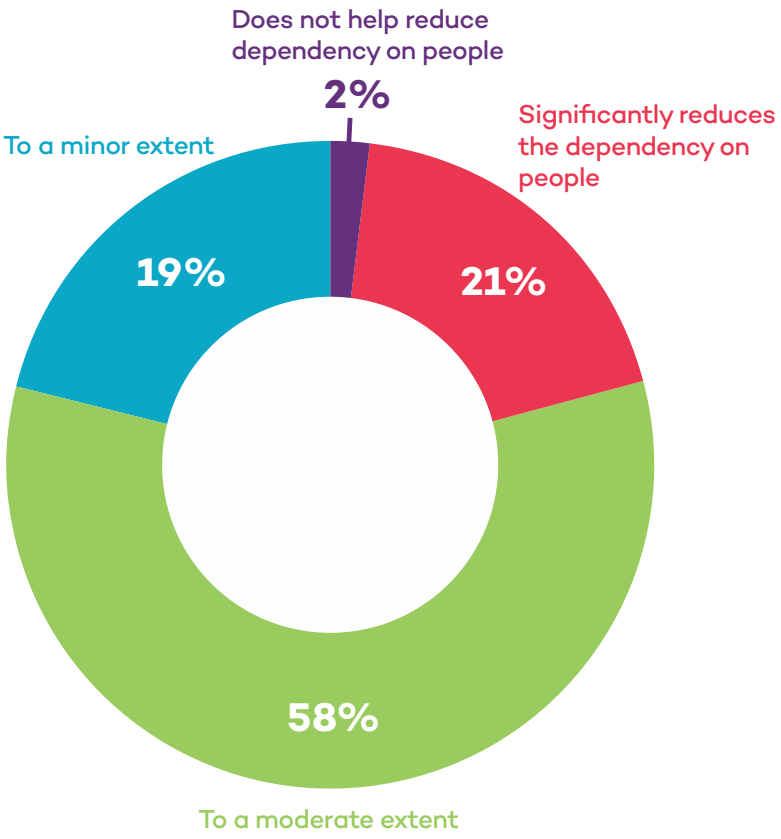
Predictive maintenance and human capital – Upskilling and finding champions

Predictive maintenance is not expected to have a major impact on manufacturers' dependence on human capital to perform maintenance tasks. They do, however, expect skillsets to shift over time. For example, the labor involved in emergency repairs or day-to-day inspections, such as checking temperature or vibration of critical equipment, can be re-deployed to handle things like continuous improvement processes. "We're growing, and at the same time struggling, to recruit enough people at all levels – from the shop floor, the skilled trades, engineers, and all the way through. So, it's important that we bring in new staff, train them, and retain them," said Rachel Lecrone, Director of Manufacturing IT and Industrial Controls of **Cummins**, a provider of diesel and alternative fuel engines and electrical generator sets.

Change management is also vital. Getting everyone invested in the adoption of PdM can in many cases involve culture change among leadership and staff alike. The resident "machine whisperer" may prefer to rely more on instinct rather than hard data. Andrea White of Sonoco talked about the importance of "believing the data." "The main thing we've had to establish is the belief in the data over the last many years. It took us awhile to actually get all operators, managers, and staff to overcome their doubts. We're there now, but it took some time. Old habits die hard," she continued.

To speed up the process, it is critical to involve maintenance team members in the PdM program from the outset. "Find a champion, make them think it was their idea, and use PdM to prove them right," is the advice of Micah Statler at ATS. Another accelerator of deployment is a quick win. "Early successes with PdM can help generate buy-in and gain trust. If you can implement these things and actually show a credible benefit early, it can get adopted a lot faster," Kevin Davis, Lab Operations Manager at Cummins Turbo Technologies told us.

How much predictive maintenance helps reduce dependency on people and increase the reliance on technology



Predictive Maintenance – Proven Productivity and ROI

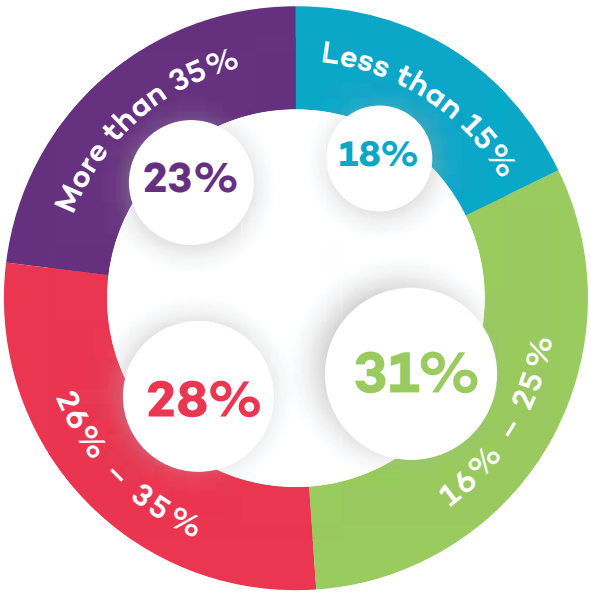
Productivity gains are the norm

One of those quick wins will likely be a boost in productivity, which is so important in an environment with **increasing capacity utilization**, **high backlogs, and record lead times**. More than 95% of manufacturers we surveyed increased productivity as a result of implementing predictive maintenance.

For most, these increases were substantial. More than half of our respondents registered productivity gains in excess of 25% and nearly a quarter saw gains over 35%. At ELLWOOD, where a 30-minute breakdown in a furnace can impact processes both upstream and downstream, they were able to cut downtime in half. Other manufacturers in our survey reported on improved ability to manage aging equipment.

While increasing uptime and therefore plant availability are both enormous benefits, our panel saw additional productivity benefits in terms of maintenance staff utilization. As Bishwajit Ranjan at ELLWOOD put it: "We were able to reduce manual inspections wherever we implemented PdM. That manpower could be used for different continuous improvement activities or a new process. The effect is cumulative, in some cases even exponential."

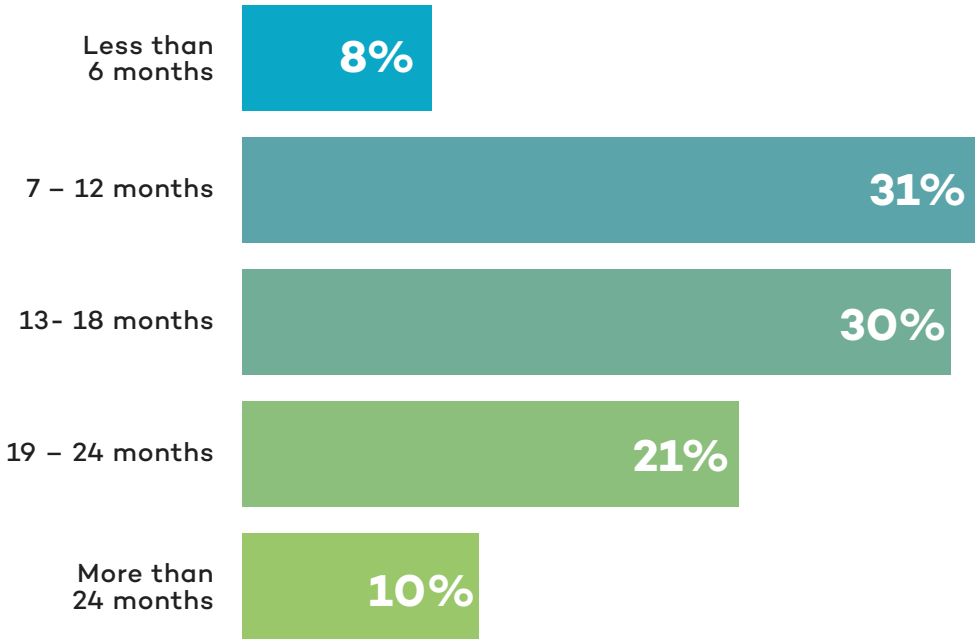
Productivity increases after implementing PdM (in percentages)



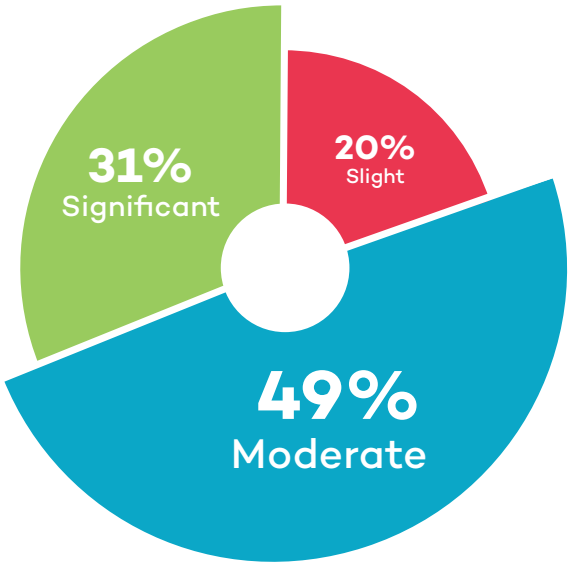
A rapid ROI for most

For 90% of respondents who have started predictive maintenance, their investment generated a return in under two years, and many (39%) saw an ROI within one year. "When we started, we were seeing an ROI within months. This is especially true in divisions with major equipment, costly bearings, motors, etc., such as our paper business," Andrea White of Sonoco told us.

End to end, how quickly did you see ROI from PdM initiatives?



Return on investment experienced since implementing PdM



A major rail car manufacturer achieved an **eight-fold ROI** just two months after installing PdM sensors, Micah Statler at ATS told us. A sensor installed on a blaster motor recorded vibration and temperature levels that periodically exceeded alert thresholds. This triggered email notifications to the site supervisor warning of the condition, and this generated a task in the plant's Computerized Maintenance Management System (CMMS). On-site maintenance technicians investigating the problem discovered loose mounting bolts and were able to address the problem outside of production hours utilizing $300 worth of in-stock parts.

The condition monitoring system was the key. It detected the problem early enough for the manufacturer to jump into action and avoid significant costs that would have been caused by lost production time, major equipment failure, rush parts, etc. Repair time was also much shorter – four hours as opposed to a week for a standard motor replacement.

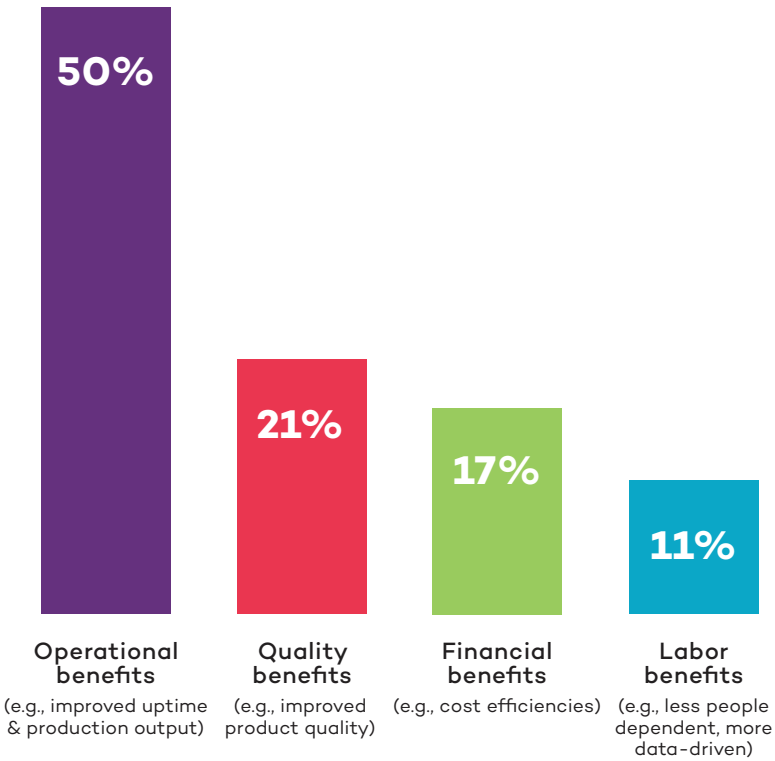
Benefits beyond operational improvements

This story had a happy ending not only for this rail car manufacturer but also for its customers. With **rail cars in tight supply**, being able to maintain uptime and meet surging demand is delivering an important competitive advantage that extends beyond the railway companies to the farmers and manufacturers using their services and ultimately to the consumers who buy these goods.

Another benefit that transcends pure operational gains is quality, which ranked as the second most important PdM benefit in our survey. Erin Welken of Johnson Controls, explained: "When you have a quality issue or the line goes down, having a PdM system enables you to go back to the history and analyze the different elements. By analyzing things like vibration, heat, run time, tool changeovers, etc. you can put together a more robust story of why the process drifted from the expected state. Sometimes you find that the problem wasn't a mechanical issue, it was a material issue that caused the downtime or defect."

> **"For us, the mean time between failures could be a decade. But if a PdM system saves us once, it's worth having."**
>
> **— Brian Thie, USG**

Benefits from using PdM tools



Talent – Technology's Secret Sauce

New strategies to win and retain scarce talent

Adopting PdM hinges on having not only the right technology but also people with the right skill sets to maximize the impact of that technology. In our survey, 75% of the sample agreed with the statement, "We need a workforce that is more technologically skilled now that we have implemented predictive maintenance." That's why companies are focused on how best to attract, develop, and retain that talent.

ELLWOOD's approach is to focus on recruiting individuals with knowledge of manufacturing processes or machinery rather than pure data analysts. As Bishwajit Ranjan put it, "Let's say somebody is coming with fluid power academic knowledge. We can then provide custom training about our asset so that they understand the data and how to interpret it in terms of asset health. I don't see the requirement of that manufacturing knowledge going away. What I do question is whether 25 years of experience is as valuable as it once was for this type of role." When asked why, Ranjan explained, "The hard part is being done by the sensors and the software. They can now tell you, for example, these three data points are here, so out of 50 possible root causes, the technology already eliminates 47. And the software is getting smarter every day."

Sonoco is looking to add data scientists to expand its continuous improvement bench strength. Andrea White sees it as a short- and long-term process: "We need more continuous improvement folks to come up through our ranks to have bench strength here to build up into the leadership team. I think we're going to do that regardless of predictive analytics."

"We certainly cannot afford to lose skilled technicians in this market."

— James Gregory, JTEKT

Condition monitoring support at the ATS Reliability 360® Technology Center. Image courtesy of ATS.

Talent – Build, buy, or outsource?

Upskilling existing talent is also an important part of the equation. Transitioning people from labor-intensive tasks to data analysis requires guidance and training, says James Gregory, Senior Vice President of Manufacturing at **JTEKT**, a provider of engineering and manufacturing automotive systems, bearing solutions, and high-performance machine tools. JTEKT is finding new ways to use the excess maintenance capacity created by PdM by repurposing these individuals to work on machine reliability and process improvement initiatives. "We certainly cannot afford to lose skilled technicians in this market," Gregory said.

Whether to build, buy, or outsource these skills is an open question for many. At Johnson Controls, Erin Welken talks about the value of a hybrid approach: "Half of the team is internal, the other half is the consultants. Ideally, the team is partnering and developing a solution together. Once the consultants are gone, you still have a group of people in-house who can continue to enhance and build on what has been created, knowing that technology never stays the same."

Outsourcing clearly paid off quickly for one consumer packaged goods company. Within 30 days of launching a 60-day trial with ATS, the company was alerted to production anomalies in time to avoid $86,000 in losses and 32 hours of unplanned downtime in one of its aluminum can manufacturing sites alone. A similar trial in one of its glass bottle manufacturing plants helped the company avoid $100,000 in downtime costs. Following these successful trials, the company replaced all manual, route-based monitoring at its 20+ U.S. manufacturing sites **realizing $2M in avoided losses**, an ROI of 150%.

The Future – Smarter, Faster and Driven by Data

The importance of predictive maintenance will continue to grow in the near- and long-term. Especially now, with downtime – both planned and unplanned – being the enemy of growth. "I would say PdM is higher priority now for us and becoming much higher for our customers as well," Will Durfee of Hexagon told us.

Sensor technology is becoming more powerful and compelling every day. Some of the latest developments include **sensors with batteries that last forever** because they scavenge power from heat, light or even vibrations. With each iteration, sensors provide more detail about equipment issues making them smarter and helping maintenance teams get to root cause faster than ever before. Likewise, the body of knowledge about maintenance is always growing, making it easier to do accurate modeling, effective forecasting, and innovative data analysis.

Companies are learning that they can stop maintenance problems before they start and accrue the benefits both upstream and downstream in their organizations. The most advanced among them have already started and are finding new ways to build their bench strength for a data-driven future.

Recommendations for Action

Find a champion for PdM in the maintenance team and involve them early.

Invest in training your maintenance teams for new tasks.

Over time, make data skills part of your leadership team profile across the board.

Don't try to measure everything or analyze all the data. Start with two data points. Focus on the value.

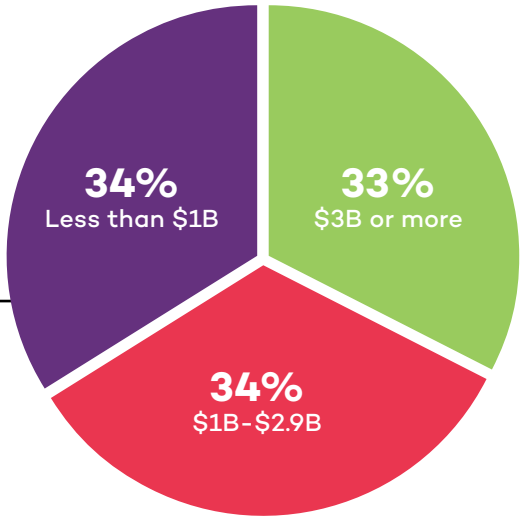
Consider the competitive advantage.

Keep measuring the value of your PdM system after the pilot phase including costs avoided.

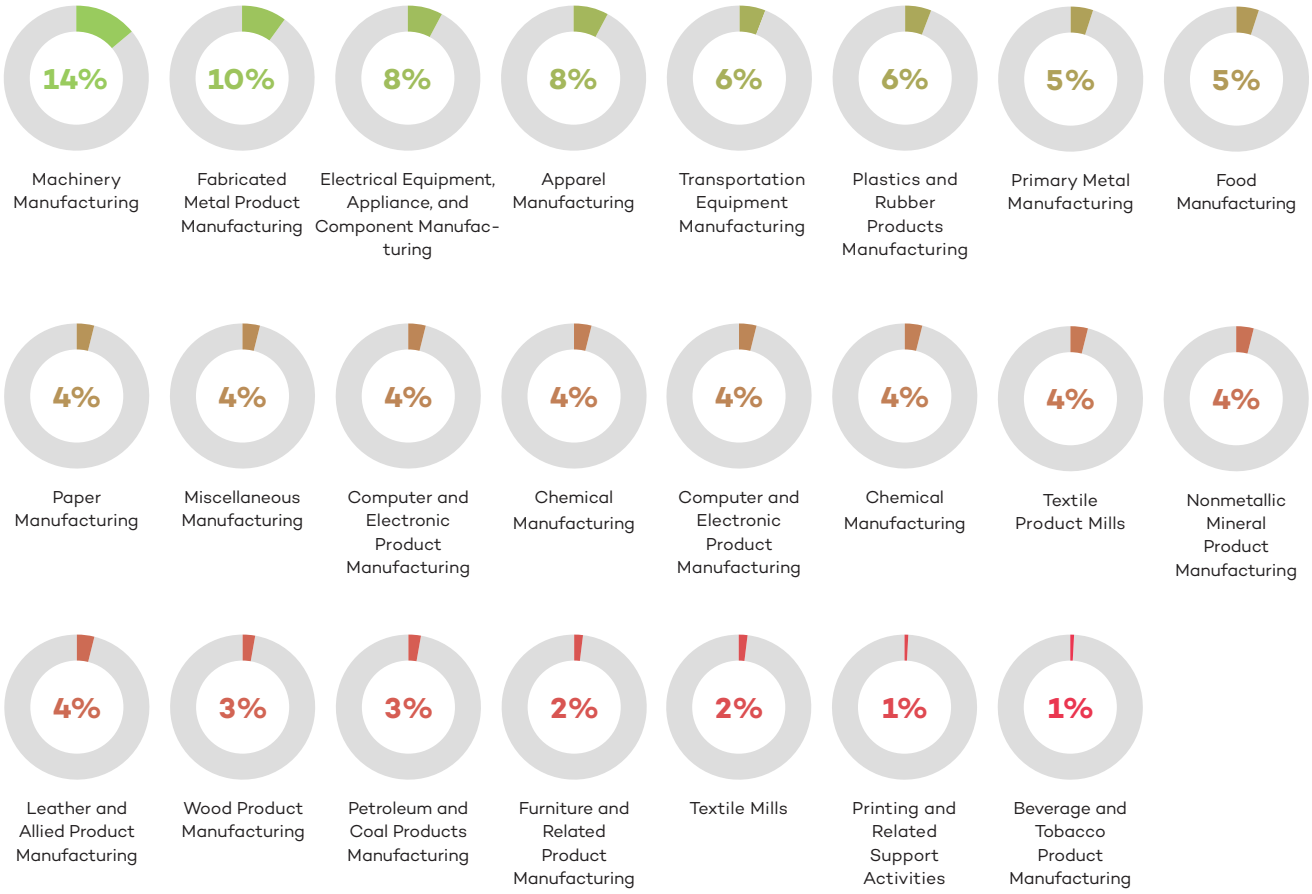
About the Survey

Manufacturers Alliance and ATS surveyed 170 leaders in manufacturing to better understand their predictive maintenance initiatives. The Alliance has highlighted some statistics about the companies surveyed.

Annual Revenue



Primary Industry



Manufacturers Alliance Foundation is the 501(c)(3) partner of Manufacturers Alliance®. The Alliance Foundation provides educational opportunities for the manufacturing community and its stakeholders through insights, events, and tools for today's most critical business decisions. The Alliance Foundation focuses on talent, technology, digital transformation, and competitiveness. For more information, visit **ManufacturersAlliance.org/foundation**.

Advanced Technology Services, Inc. (ATS), is a leading industrial services provider with over three decades of proven experience in technology-driven industrial maintenance and MRO asset management. Through a technically skilled workforce, best-in-class processes, and Industry 4.0 technologies we deliver increased asset performance and productivity to many leading process and discrete manufacturers. ATS is headquartered in Illinois with regional offices located throughout the U.S., Mexico and U.K. Learn how we make factories run better and smarter at **www.advancedtech.com**.