



# Industrial Maintenance

2022 Status, Trends & Technology Report



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## ABOUT ADVANCED TECHNOLOGY SERVICES

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 improved asset health and productivity to many leading manufacturers. Learn how we make factories run better and smarter at [www.advancedtech.com](http://www.advancedtech.com).

## EXECUTIVE SUMMARY

Enduring and new challenges are pressuring asset-intensive industries to maintain peak availability, safety, and performance of their equipment and operations. Plant operations and maintenance organizations, still recovering from Covid's acute repercussions on staffing and the global supply chain, are also dealing with ongoing microeconomic and geopolitical trials as they try to optimize asset uptime and utilization.

Significant skilled labor gaps and recruiting challenges remain for manufacturers, utilities, and facilities managers. Ready availability of critical parts is rarely assured. Regulatory requirements are in flux and increasingly demanding. Environmental, health, and safety risks remain a huge liability. And critical asset failures and unplanned downtime are continuing threats.

Meanwhile, maintenance and reliability organizations wanting to ensure peak machine health are constrained by limits to executive and financial support. Prioritizing and justifying investments in organizational, technological, and culture improvements is difficult but necessary to gain traction in reducing maintenance costs, improving profitability, and achieving operational excellence.

The 2022 Industrial Maintenance Report, developed by Plant Engineering in partnership with ATS, was developed to assess the current and planned state of maintenance practices and strategies in manufacturing and other industrial facilities, along with perceptions about modern software and technology solutions.

The study asked the respondents about the time spent on maintenance tasks, frequency of scheduled shutdowns, causes of unscheduled downtime, and key factors affecting plant productivity. It examined which maintenance programs the facilities are using, to what extent, and their advantages and challenges. It also gauged the adequacy of maintenance budgets and other challenges to improving reliability and alleviating skilled labor constraints.

The research also delved into solutions such as computerized maintenance management systems (CMMS), industrial internet of things (IIoT) technologies like machine health monitoring sensors, smart analytics powered by machine learning (ML), and services such as maintenance outsourcing.

Also explored were future-focused questions revealing the facilities' plans to decrease downtime, leverage

machine data, and implement new technologies to improve industrial maintenance.

Overall, the respondents are dedicated to strengthening their facility's asset management practices and overcoming acknowledged people, process, and technology challenges to drive reliability optimization.

For instance, to better predict failures, a notable number of plants have implemented or plan to deploy condition-based monitoring sensors and intelligent analytics for key assets. Continuously tracking fine variances in machine performance and indicators of condition health, such as vibration, temperature, and motor function, improves productivity and reliability by prompting timely measures to prevent faults, unplanned shutdowns, and especially catastrophic failures.

Additionally, several persistent talent-related challenges are a significant concern. Difficulties in recruiting, training, and retaining sufficient personnel, coupled with budget limitations, increase risks and hinder the ability to meet maintenance and reliability goals. A telling finding is that 86% of plants now outsource some or all of their plant maintenance operations—an increase of 21% over last year's report—for an assortment of business and technical reasons.

Stakeholders at all levels in industry have much to gain by reading this insightful research study. The compilation of real-world perspectives of the current state, challenges, trends, and plans of asset-intensive organizations sets a benchmark for reliability professionals seeking to drive improvements, and for their employers striving to better compete and excel.



## SURVEY METHODOLOGY

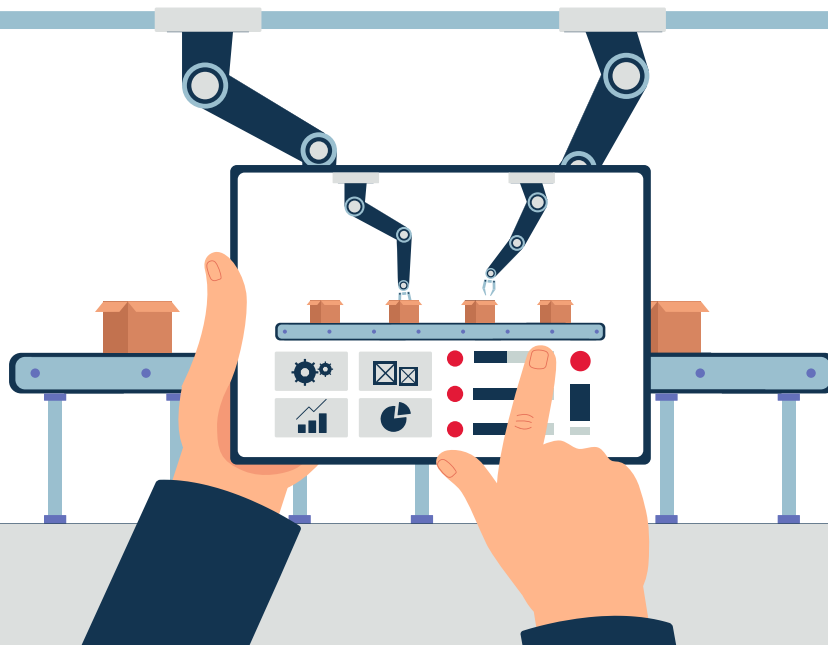
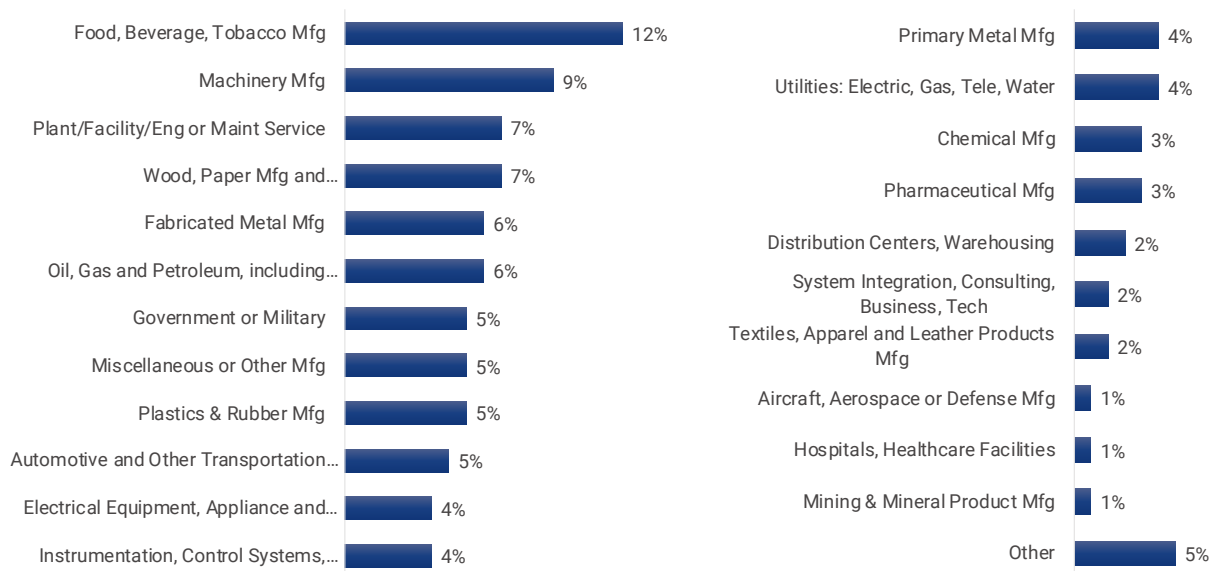
For this year's Industrial Maintenance Report, a sample of qualified Plant Engineering magazine subscribers who are responsible for maintenance for all or part of their facilities were invited to participate. The 158 respondents answered questions about topics ranging from their facility's maintenance practices and strategies to the effects on productivity and profitability. The data was collected during the latter half of March 2022.

The average respondent has worked in the manufacturing industry for 26 years, including 42% for 30 years or longer.

Sixty-eight percent are in engineering, maintenance, or supervisory roles and 30% are in general management. Forty-one percent work in facilities that employ 250 people or more.

The businesses represented are primarily manufacturers, with the majority being in food, beverage, tobacco, or machinery manufacturing. Employees of industrial service providers, utilities, and other asset-intensive businesses also participated.

### WHAT IS THE PRIMARY BUSINESS AT YOUR LOCATION?



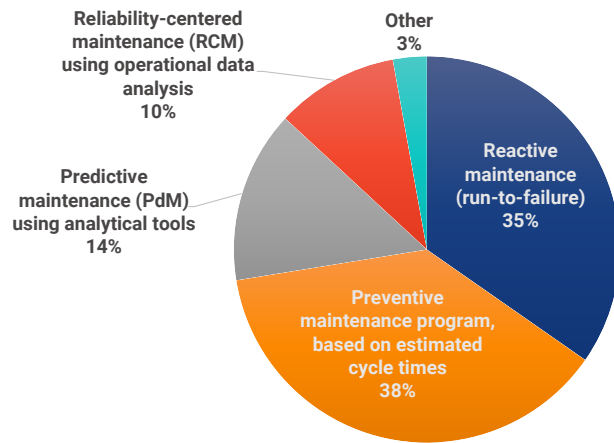
## MAINTENANCE PROGRAM USAGE

The study found that the average facility has three maintenance programs in place. Of all the assets under maintenance, 38% are reported to be managed with preventive maintenance (PM) based on estimated cycle times.

The second most used program is reactive maintenance, with respondents indicating their facility lets 35% of their equipment run to failure before it is repaired or replaced. This may be a reasonable approach for low-criticality, low-cost equipment where the return on investment for more proactive approaches is not significant.

Fourteen percent of the assets are managed with predictive maintenance (PdM) programs using analytical tools, and 10% benefit from reliability-centered maintenance (RCM) programs using operational data analysis. These strategies tend to be targeted to higher-criticality assets.

### USAGE OF MAINTENANCE PROGRAMS



\*Chart displays the average of percentages

## MAINTENANCE PROGRAM CHALLENGES

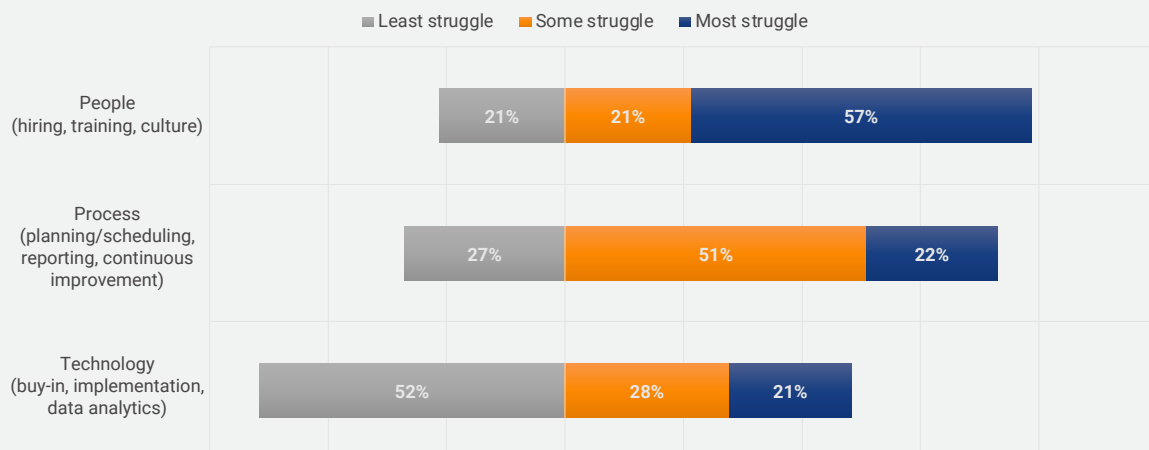
A combination of people, processes, and technology determine maintenance program efficiency and effectiveness. In 2022, the study's respondents were asked to rank these three factors by how much of a struggle they represent.

Fifty-seven percent consider people-related issues such as hiring, training, and culture the most challenging. Those who report it presenting the "least struggle" or "some struggle" are evenly split at 21%. Processes such as planning/scheduling,

reporting, and continuous improvement are a moderate challenge for 51% of the respondents. Only 22% consider processes to be the greatest struggle and 27% wrestle with it the least.

Like last year, technology fared best. Technology buy-in, implementation, and data analytics present the least struggle for 52%, some struggle for 28%, and the greatest struggle for just 21% of the respondents.

### CHALLENGING ASPECTS TO MAINTENANCE PROGRAMS



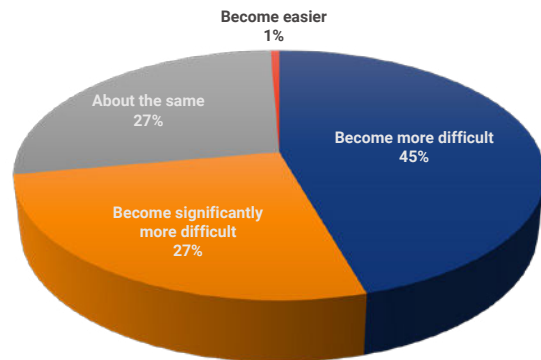
### LABOR RECRUITMENT CHALLENGES

Competition for skilled workers in manufacturing industries is intense. The study found that recruiting technically skilled labor in this market has become a greater concern in the last 12 months.

Of the respondents, 72% report that the challenge is heightened, including 27% saying it is significantly more difficult and 45% saying it is more difficult. Only 27% consider the challenge about the same as last year.

With the unemployment rate near historic lows, increasing efforts to attract and retain skilled talent and develop skills in personnel who show promise, and/or outsourcing roles to third-party service experts, is necessary to ensure operational continuity and meet performance and safety goals.

### DIFFICULTY OF RECENT LABOR RECRUITMENT



### REASONS FOR MAINTENANCE OUTSOURCING

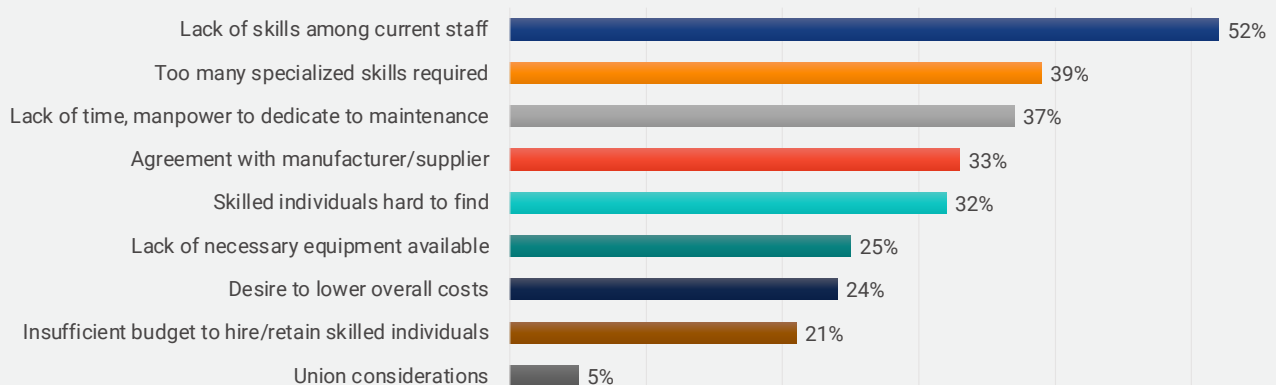
By far, the leading driver for outsourcing maintenance is a lack of skills among current staff. Fifty-two percent of respondents reported this as an issue, increasing from 40% in the 2021 survey. Last year's leading reason for outsourcing, an agreement with the manufacturer or supplier, decreased from 44% to 33% this year.

The talent concern is echoed by the 39% citing the need for too many specialized skills at the plant, 32% saying skilled

individuals are hard to find, and 21% lacking a sufficient budget to hire or retain skilled individuals. Consequently, 37% report a lack of time or manpower to dedicate to maintenance.

Other outsourcing reasons involve lacking availability of necessary equipment, wanting to lower overall costs, union considerations, and other factors such as certification and licensing requirements, liability, and safety concerns.

### REASONS FOR OUTSOURCING MAINTENANCE



## BARRIERS TO IMPROVING MAINTENANCE

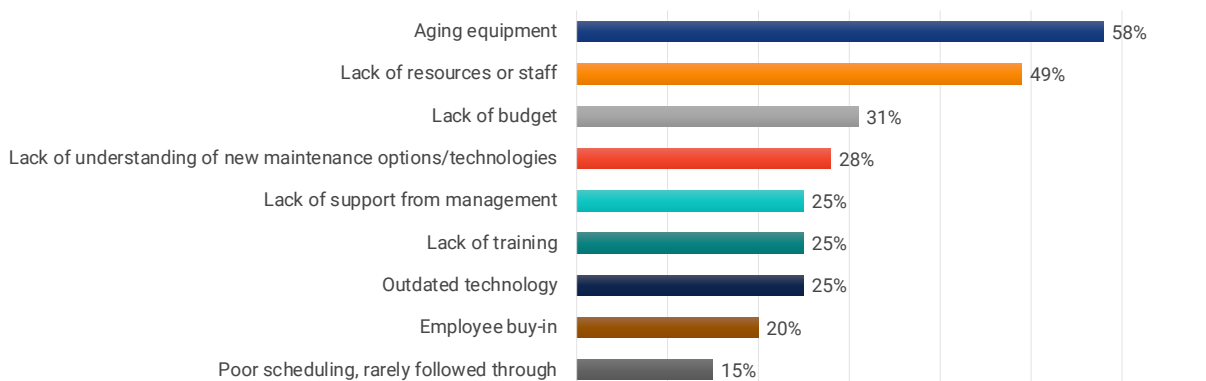
The number-one challenge to maintenance improvement is aging equipment, as cited by 58% of respondents. Second is a lack of resources or staff, with 49% reporting that as an issue—an increase from 34% in 2021.

Modern processes and technologies are also an issue but less so than in 2021. This year, 28% report a lack of understanding of new maintenance options and technologies at their facility being an issue, compared to 37% last year. Twenty-five

percent report outdated technology as a barrier to improving maintenance, a reduction from last year's 34%.

Budget constraints, observed by 31% of respondents, coupled with a lack of management support (25%) and inadequate employee buy-in (20%), are restricting the ability to improve maintenance. Other challenges include inadequate training, scheduling, and follow-through.

### KEY CHALLENGES TO IMPROVING MAINTENANCE



## PLANS TO REDUCE DOWNTIME

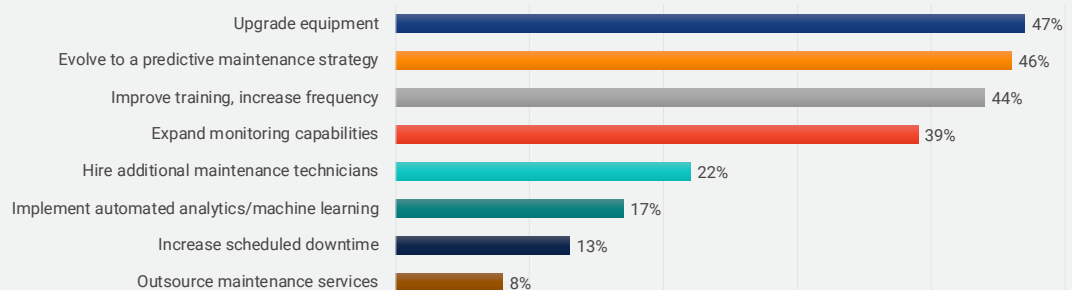
Unscheduled plant downtime often comes at high risk and cost, and multiple strategies are planned to decrease the incidences. Upgrading equipment is the most frequently reported intention, at 47%. Increasing maintenance efficiency is also dominant, including 46% aiming to evolve to a PdM strategy, 39% aiming to expand monitoring capabilities, and 17% intending to implement automated analytics/ML.

Compared to using human senses or conventional monitoring tools, processing condition monitoring data with analytics

powered by AI/ML algorithms improves maintenance efficiency and predictability by detecting incipient anomalies, faults, and failures more precisely.

Labor-oriented approaches to reducing downtime include improving or increasing the frequency of training (44%), hiring additional maintenance technicians (22%; up from 10% in 2021), increasing scheduled downtime (13%), and using outsourced maintenance services (8%).

### PLANS TO DECREASE DOWNTIME



## FACTORS AFFECTING PRODUCTIVITY

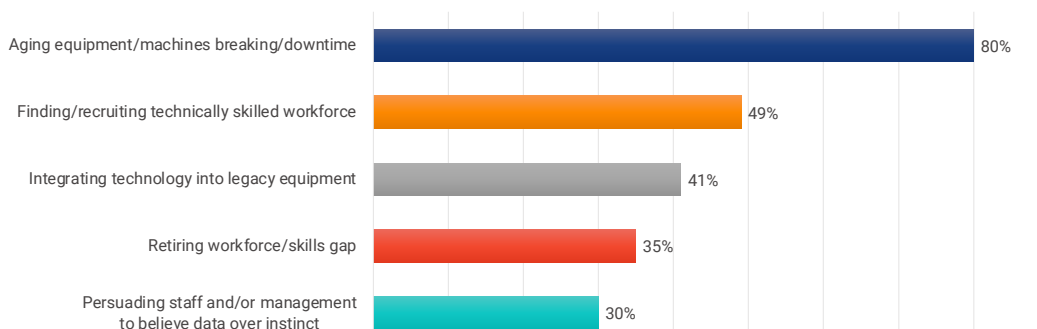
Plant productivity impacts are not significantly different from last year. The biggest factor in 2022, at 80%, is aging equipment or machines breaking down and creating unscheduled downtime. It brings other scheduled work to a halt while the unexpected failures are investigated and corrected.

Approximately half of the respondents cite that finding and recruiting a technically skilled workforce affects productivity,

along with 35% mentioning workforce retirements and skills gaps. Both conditions lead to resource limitations and less work getting done.

A presumably positive affect on productivity is integrating technology into legacy equipment, as noted by 41% of respondents. Likewise, persuading personnel and management to trust the data rather than relying on instinct is observed by 30% as influencing productivity.

WHAT AFFECTS PLANT PRODUCTIVITY



## IIOT IMPACTS ON MAINTENANCE

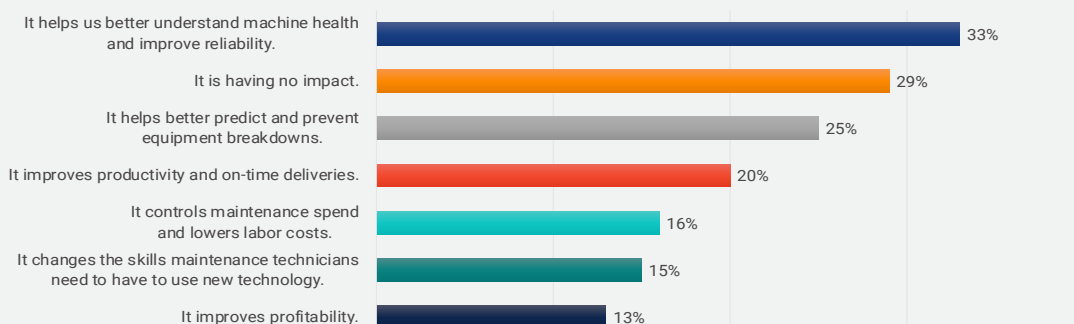
Numerous perceived advantages of applying IIoT-related technology to plant maintenance operations are illuminated by the study. For instance, it helps to better understand machine health and improve reliability (33%) and better predict and prevent equipment breakdowns (25%).

In turn, operational and financial performance gains are enabled. It improves productivity and on-time deliveries for

20% of the respondents, keeps maintenance spend and labor costs under control for 16%, and improves profitability for 13%.

In addition, 15% believe it changes the skills needed for maintenance technicians to use the modern technologies. Intuitive and automated technologies can simplify specific tasks while also freeing up time for the users to direct their talents toward more strategic work.

IMPACT OF IIOT ON MAINTENANCE OPERATIONS





## TECHNOLOGY IMPLEMENTATION PLANS

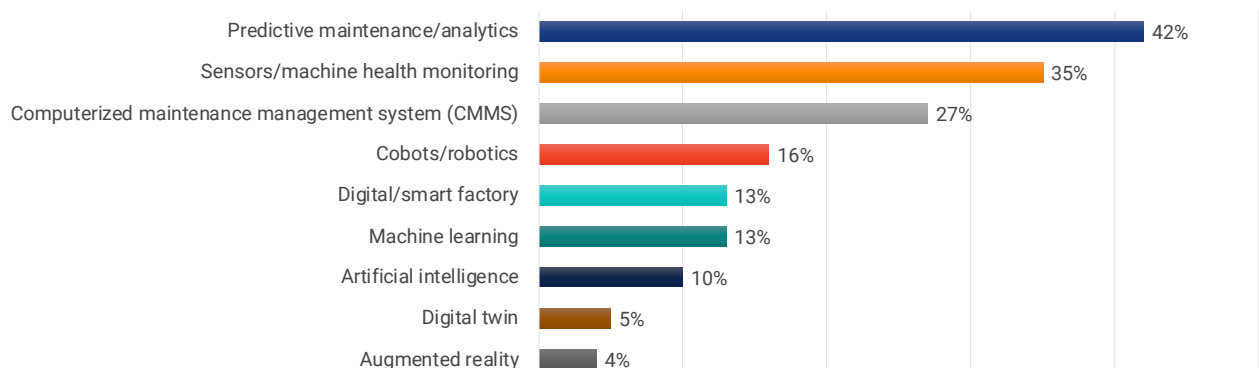
Plants that are planning to implement new or additional technologies are most commonly targeting PdM and analytics solutions (42%) and sensors for machine health monitoring (35%). Both technologies facilitate the efficient and cost-effective best practices of predictive and condition-based maintenance, while reducing reliance on reactive maintenance performed after the asset fails and PMs performed regardless of the asset's condition.

Also notable is the 27% planning to implement a computerized system for managing assets and maintenance. Whether a

new implementation or an upgrade, having a well-developed and actively used CMMS is foundational to the ability to track and manage plant assets and their parts and components, including locations, statuses, and maintenance histories, in a single, centralized solution.

Advanced technologies such as robotics and collaborative robots (cobots), AI/ML, and digital/smart factory solutions are also in the plans for some respondents.

### TECHNOLOGY IMPLEMENTATION PLANS



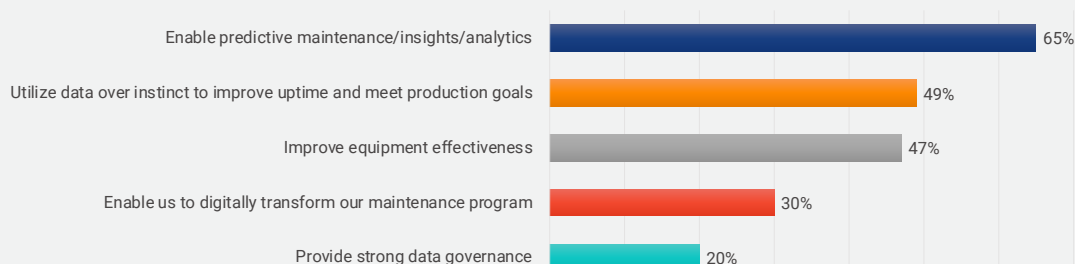
## MACHINE HEALTH MONITORING BENEFITS

Expectations are high for machine health monitoring for production equipment. First and foremost, they are anticipated to enable PdM, insights, and analytics, according to 65% of the respondents.

In addition, nearly half expect the ability to improve uptime and meet production goals by relying on data over instinct (49%) and to improve equipment effectiveness (47%).

Another 30% view machine health monitoring as enabling digital transformation of their maintenance program and 20% believe it will support strong data governance. The technology advances digital transformation and data governance by replacing formerly manual and disconnected systems and processes with digitalized, connected solutions that support data-driven work management and process efficiencies.

### ANTICIPATED BENEFITS OF MACHINE HEALTH MONITORING



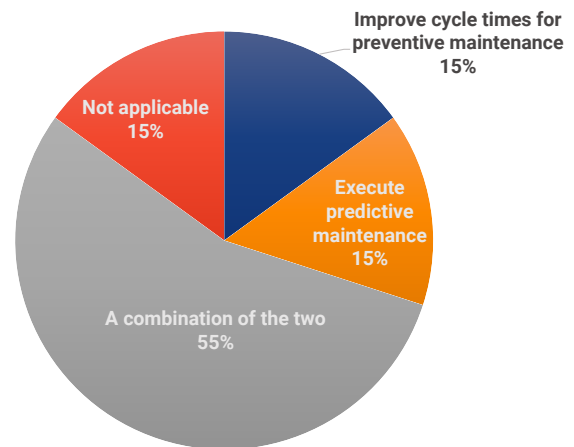
## CONDITION-BASED MONITORING GOALS

Systematic, real-time condition-based monitoring of running machine and facility assets not only helps to automate PdM, but the data can also be used to upgrade scheduled PM and PdM timing to avoid missed signals that can lead to costly asset failures.

For critical assets, using machine health monitoring sensors and AI/ML analytics instead of handheld PdM data collection devices can reveal degrading or suspect conditions much earlier in the failure curve. For less critical assets, condition-based monitoring data can be used as needed to improve the timing of manual PdM tasks as well as PM rounds that are typically calendar- or usage-based regardless of environmental or process conditions.

For more than half of the study's respondents, the stated goals for condition monitoring (whether implemented or planned) are twofold. Fifty-five percent expect it to improve cycle times for PM and additionally allow them to execute PdM. Meanwhile, 15% name the PM benefits alone as their goal and another 15% have the PdM benefits as their singular objective.

GOAL OF CONDITION-BASED MONITORING



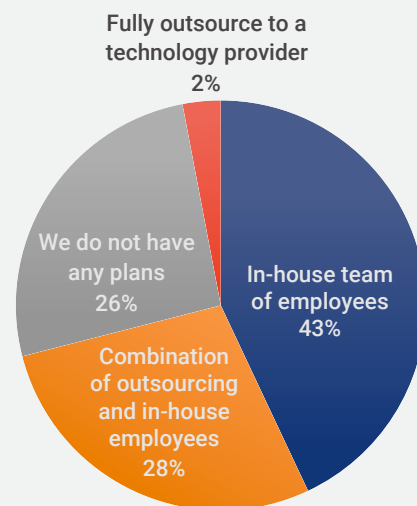
## COLLECTING, ANALYZING, AND ACTING ON THE DATA

Capturing industrial machine data, whether continuously streamed or at pre-determined intervals, enables ongoing refinement of PdM efficiency and effectiveness. Machine or process adjustments or corrections can be made right away if the priority is high, otherwise tracked and addressed during a conveniently scheduled outage.

The most advanced form of intelligent, data-driven PdM not only predicts failures but also learns how to recommend or “prescribe” corrective actions for the observed conditions, enabling what is known as prescriptive maintenance (RxM).

A full 71% percent of the survey's respondents expect to collect, analyze, and act on machine data in the next one to three years. Of that number, 43% plan to do so using in-house employees, 25% plan to use a combination of in-house employees and outsourcing to a third-party technology provider, and 2% plan to fully outsource to a technology provider.

COLLECTING, ANALYZING & ACTING ON MACHINE DATA



## ADVANCING INDUSTRIAL MAINTENANCE

“Industrial maintenance and reliability are clearly in the spotlight for organizations seeking to improve safety, asset performance, and profitability. It is heartening to see the interest in upgrading maintenance practices and solutions—and yet, the economics of wants and needs are at play. Barriers the facilities need to overcome are keeping them from accomplishing all they want to do. For instance, the widespread industry shortage of skilled labor is a pressing concern because under-resourced plants are at-risk plants, and the solutions draw funds that could otherwise be spent on process or technological advancements.

At ATS, we help organizations make their factories run better and smarter. Combining a skilled technical workforce, optimized processes, and Industry 4.0 technologies, our industrial maintenance services improve asset health and productivity. Through our industrial technologies, we provide machine health monitoring with data analytics and prescriptive action support to eliminate unplanned downtime. Our maintenance, repair, and operations (MRO) asset management services ensure critical parts are well managed for even greater manufacturing efficiency. With a variety of services and solutions, ATS has a proven track record in helping manufacturers increase uptime, improve production output and reduce costs.

**Jeff Owens, CEO**

Advanced Technology Services, Inc.

For information about how your maintenance operations can be improved now and long term, go to [www.advancedtech.com](http://www.advancedtech.com) or call 855-834-7604.



