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A Field Guide to AI for Maintenance

From Firefighting to Future-Proofing, One Decision at a Time

Industrial organizations are paying close attention to developments in artificial intelligence (AI), with many already exploring its potential in areas such as maintenance and reliability. It has captured the imagination of executives and other leaders eager to reduce costs and maximize performance, sparking reactions ranging from curiosity and apprehension to anticipation and excitement.

For reliability and maintenance teams tasked with maximizing operational efficiency, industrial AI presents a unique opportunity. Organizations can shift from reacting to costly equipment failures to proactively predicting and planning maintenance needs.

The business case for AI is so compelling that its contribution toward long-term competitiveness is recognized right up to the C-suite. One independently conducted survey found that 99% of industrial decision-makers could see how an AI strategy could deliver value for their business. Another report found that 86% of manufacturers running generative AI (GenAI) in production are reporting increased revenue estimate gains of 6% or more.

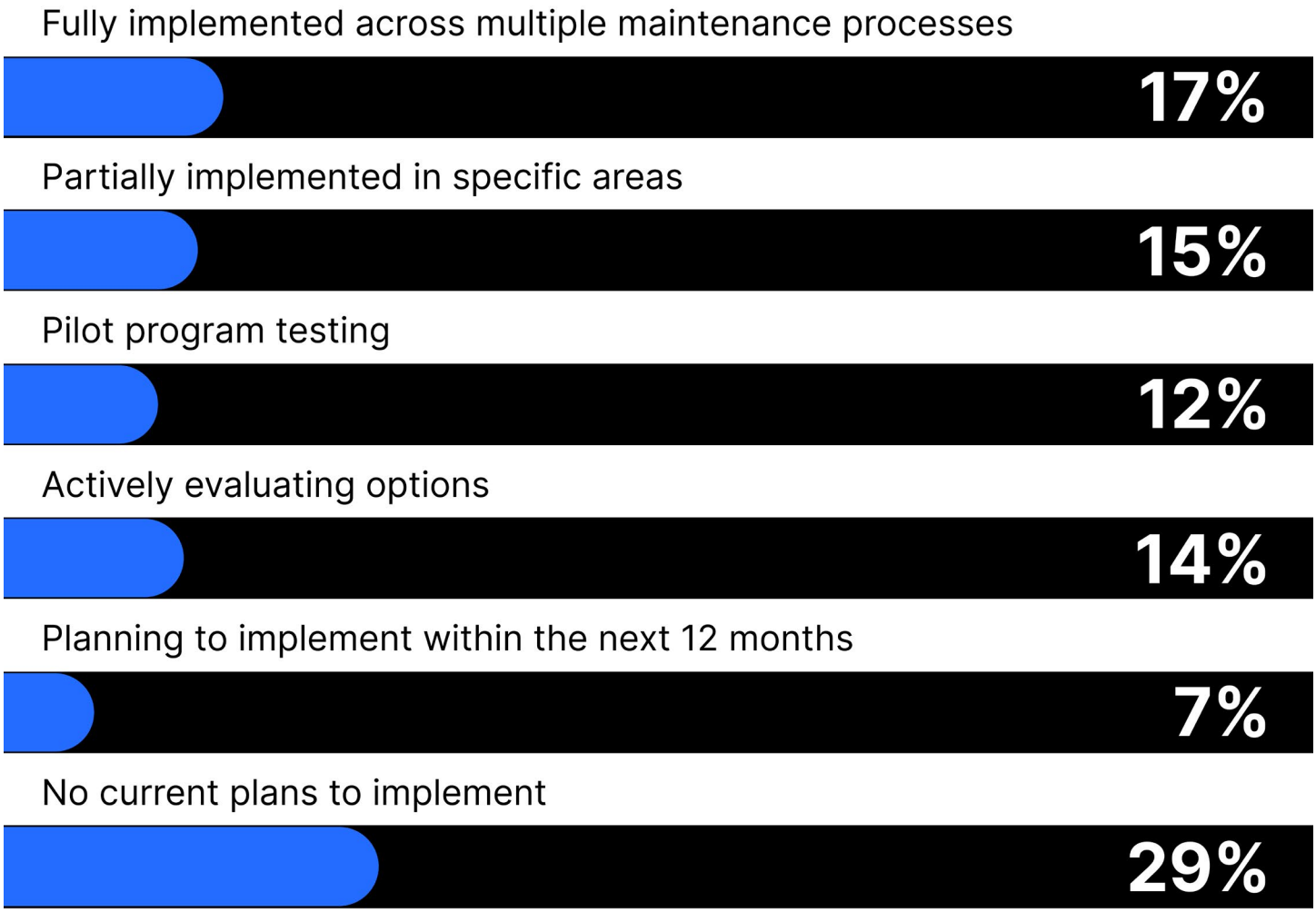
Yet, pressure from leadership to "do something" with AI is at odds with the practical challenges and often limited understanding of what it is and what it actually takes to make scalable AI successful in a maintenance organization.

This paper, which includes research findings from the 2025 State of Industrial Maintenance report, will address the current state of AI in industrial maintenance, challenges and benefits of deploying AI for maintenance operations, and how to ensure AI delivers real results.

AI ADOPTION IN INDUSTRIAL MAINTENANCE

AI interest and adoption in industrial maintenance are surging. According to our 2025 report, more than 44% of respondents say they have already implemented AI solutions within their organization, whether in pilot mode or partial or full implementation. Another 21% are actively evaluating options or planning to implement AI within the next 12 months, indicating that by 2026, roughly 65% of industrial maintenance organizations will be using AI in some capacity. Only 29% have no current implementation plans.

AT WHAT STAGE ARE YOUR OPERATIONS IN ADOPTING AI-POWERED MAINTENANCE SOLUTIONS?



44% have AI-powered maintenance solutions fully or partially implemented or being piloted.

SIX AI CHALLENGES AND HOW TO OVERCOME THEM

From maximized asset uptime to improved output quality, the extent to which teams achieve their goals around AI implementation depends on how effectively leaders manage these programs. AI-powered efficiency gains and the digital transformation of asset management are achievable with awareness of the following key challenges and methods:

1. The AI Trap

AI is not a magic bullet. Clarity about what AI really is and how it works is essential to avoid the AI trap, where teams rush to adopt the technology without having the right foundation. This can lead to failed or ineffective implementations, a loss of confidence in the technology, and aversion to further AI investment.

To keep AI efforts from failing before they begin and deliver results that fuel leadership support, start with developing fundamental trust in the quality and

integrity of existing data. You can get data AI-ready by auditing, cleaning, standardizing, and centralizing it in an enterprise asset management (EAM) system or computerized maintenance management system (CMMS).

2. Data as the Foundation

Data is necessary for AI adoption because it's only as good as the information it's trained on. Just as uncleansed data will produce faulty output ("garbage in, garbage out"), AI's ability to learn is limited to the information available to its machine learning (ML) and predictive maintenance algorithms. Organizations can significantly accelerate access to critical information by reducing or eliminating dependency on siloed data, paper records, and undocumented memories of veteran subject matter experts.

AI and ML optimization comes from integrating human-generated insights, such as work orders and shift handover notes, with machine data from Industrial Internet of Things (IIoT) sensors and operational technology (OT) systems into a single, structured maintenance software system. This process unlocks enormous opportunities for real-time visibility and improved decision-making.

3. Trust is Everything

Top-down directives and rushed AI implementations will not build trust; rather, frontline workers want tools that actually help them do their jobs better. Unless AI suggestions contain essential context and align with real-world conditions, they may be rejected as arbitrary, illogical, or unreliable. AI succeeds when frontline workers develop confidence in the tool, listen to its findings, and act on its alerts.

To help frontline teams understand, trust, and act on AI recommendations, let them actively participate in making the tools smarter from day one. This includes involving them in AI validation and ensuring that every AI recommendation has transparent citations from credible sources, such as sensor readings, OEM documentation, historical performance logs, and technician observations.

WHICH BEST DESCRIBES YOUR ORGANIZATION'S USAGE OF SENSORS / IIOT DEVICES TO MONITOR CRITICAL EQUIPMENT?

35%	21%	20%	13%	11%
Currently use it extensively	Testing or piloting	Considering adopting it in the near future	Aware of it but have no plans to adopt it	Not aware of this technology

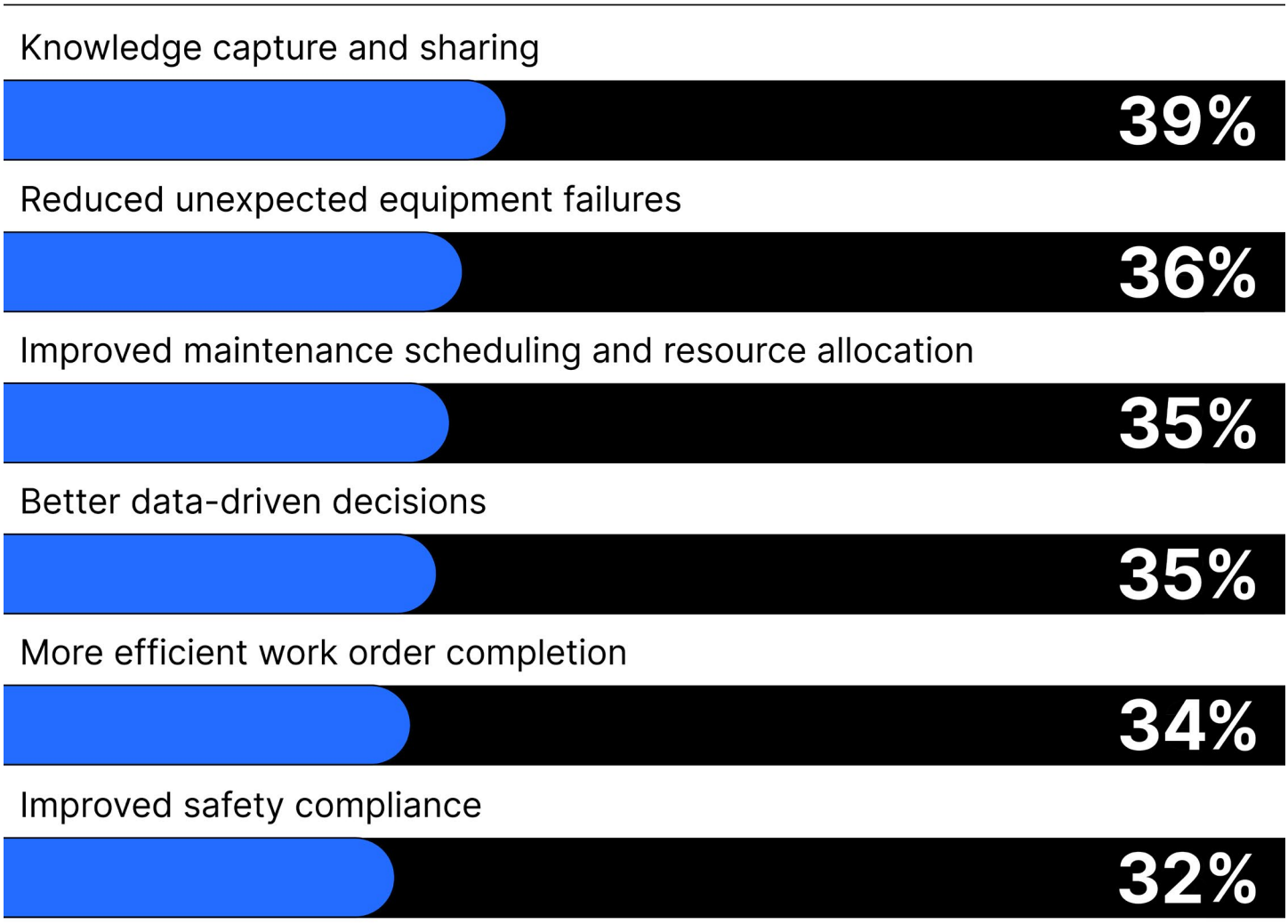
56% of respondents are currently using sensors/IIoT devices to monitor critical equipment, either extensively or in testing or piloting.

4. Implementation Framework

To avoid risking AI pilot or program failure, teams need a practical model to evaluate where they are and how to move forward. The "crawl, walk, run" framework is a phased approach to starting and scaling maintenance program implementations: Start with a single process or asset to gain small wins and promote trust with leadership and the front line before expanding the initiative to other assets, equipment, processes, or production lines.

For example, "crawl" with a very discrete use case and implement maintenance best practices that lay the groundwork for long-term success. Once positive results build confidence, "walk" out of pilot purgatory by refining and growing the project and continuing to marry machine data that is not already integrated with your EAM/CMMS solution. Then, "run" as you continue rolling out AI projects while reaching for your North Star.

WHAT BENEFITS HAVE YOU SEEN FROM AI IMPLEMENTATION IN MAINTENANCE?



Knowledge capture and sharing is the top benefit seen from AI-powered maintenance.

5. Choosing Use Cases

When deciding where to start to log immediate, practical benefits, follow the One Process, One Line rule:

- One specific process, such as vibration analysis or work order generation
- On one production line, where it is possible to control variables and measure results
- With one team, who can become internal champions

Examples of successful, real-world AI use cases for maintenance and operations exist at each step of the implementation framework:

a. Crawl: Leverage generative AI to help technicians quickly access information on demand from operating manuals, standard operating procedures (SOP), prior work history, etc., saving them a tremendous amount of time.
b. Walk: Enable prescriptive maintenance by leveraging an AI copilot tool to query condition-based monitoring data and digital information sources and build actionable work instructions on how to fix assets after a failure occurs.
c. Run: Pair AI for anomaly detection with prescriptive information, allowing technicians to prevent asset failures and create a state of predictive maintenance with, ideally, zero unplanned downtime.

6. Overcoming Perfection Paralysis

Because the stakes are so high in industrial organizations (e.g., safety, financial, and quality), well-intentioned corporate gridlock on innovations such as industrial AI and digital transformation too often occurs. Whether it's the rapid rate of AI product advancements, a fear of missing out on the next great innovation, or a culture that does not support risk-taking, some in leadership may drag their feet on new investments. Meanwhile, their existing toolsets continue to age.

Action, even imperfect action, outperforms endless evaluation cycles. To conquer perfection paralysis and get ahead of the curve, choose an AI tool that is readily interoperable with complementary tools and easy to migrate off if needed while preserving your valuable data.

THREE BUSINESS IMPERATIVES TO CONSIDER

Besides the technical considerations associated with implementing AI for maintenance operations, prominent business factors influence AI strategy decisions:

1. Future-Proofing

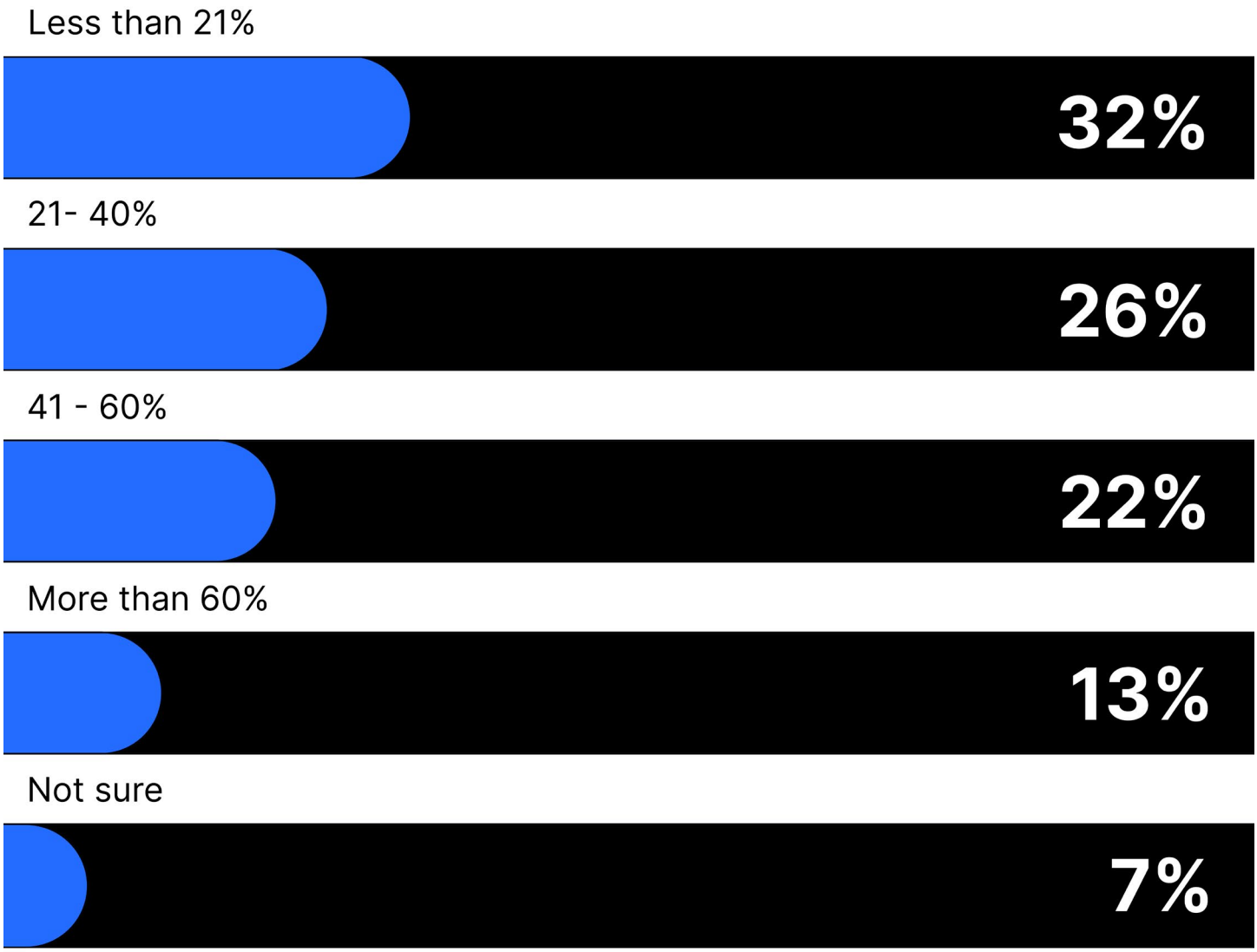
There is a fundamental technology shift happening quickly and globally, making it very difficult to forecast the timing and rate of change and what that change will look like. At the same time, there is significant uncertainty around the "three Ts" (trade, tariffs, and taxes).

To remain competitive on a global scale — and not become the next Kodak — maintenance organizations must leverage technology, automation, and AI to become as lean and efficient as possible. Transitioning from reactive, unplanned maintenance to preventive and predictive maintenance using best practices and advanced technologies substantially elevates safety, reliability, and sustainability.

2. Knowledge Transfer

Experienced technicians are retiring faster than new ones can be trained, rapidly narrowing the window of time to capture vital institutional knowledge. A Deloitte and The Manufacturing Institute study estimated that 1.9 million manufacturing jobs could go unfilled through 2033 due to increasing retirements and a lack of skilled applicants to fill those roles. Pressure is increasing to close preventable knowledge gaps as a

WHAT PERCENTAGE OF TOTAL MAINTENANCE TIME IS DEDICATED TO PLANNED MAINTENANCE ACTIVITIES?



58% of facilities dedicate less than half their maintenance time to planned work today. This points to the broader need for facilities to transition from a reactive, unplanned maintenance strategy to a forward-thinking one that prioritizes resilience and longevity.

means to protect profitability and margins.

AI offers a tremendous opportunity to shield industrial operations and critical infrastructure from the burgeoning exodus of skilled labor by modernizing systems to capture and digitize their irreplaceable insights before they walk out the door. The most resilient organizations use human-AI collaboration to amplify human expertise and transform maintenance from a reactive cost center into a proactive competitive advantage.

3. Cybersecurity

Many companies today have a strict no-AI policy. Their IT department will blacklist AI tools from the company domains, but that does not stop individuals from using

their own personal devices and free AI tools.

It is therefore important for IT to be empowered to provide frontline teams with access to enterprise-grade AI tools in a safe, vetted environment. Leading technology providers adhere to security best practices, including security and privacy controls to minimize risks to the confidentiality, integrity, and availability of the system; SOC 2 Type 2, ISO 27001, and GDPR compliance; and privacy and cookie policies that are transparent and easy to comprehend.

CONCLUSION

Today's global economic environment makes operational excellence an undisputed imperative, and industrial AI is widely perceived as holding the key to profound improvements. Organizations are increasingly exploring AI's ability to solve persistent maintenance challenges, yet it only delivers real results when teams build a strong data foundation and earn the trust of the people expected to use it.

By overcoming these challenges and employing a robust EAM/CMMS solution with AI-powered tools such as procedure generation, anomaly detection, and voice memos, maintenance organizations are able to rapidly achieve quick wins and capture lasting executive support for progressively larger and more impactful bottom-line benefits.

ABOUT MAINTAINX

Headquartered in San Francisco, MaintainX is a technology company pioneering a next-generation approach to AI-powered maintenance and asset management. It empowers frontline teams to reduce unplanned downtime and boost production capacity. MaintainX leverages AI and IoT to connect asset and work intelligence data, providing real-time insights that drive proactive maintenance and operational excellence for customers across physical asset-driven industries. MaintainX operates in North America with additional support worldwide. MaintainX is reimagining how maintenance and operations can be designed and managed to address the realities of today and the future ahead. For more information, visit www.maintainx.com.

ABOUT THE *2025 STATE OF INDUSTRIAL MAINTENANCE* REPORT

MaintainX partnered with research firm GWI to conduct an online survey for the report between late 2024 through January 2025. GWI recruited 1,320 maintenance and operations leaders from the United States and Canada. Of the respondents, 64% held decision-making roles in maintenance or operations, and 36% were MaintainX customers, representing various industries.