Microsoft

Artificial intelligence in industrial machinery manufacturing

Driving smarter manufacturing and efficiency in the machine builder industry

Signals Report – Manufacturing Spotlight

June 2025

Why read this paper?

Gain insight into the priorities of the industrial machine manufacturing industry and explore how AI is being harnessed to achieve these objectives.

The role of AI in machine building is shifting from potential to impact.
Machine builders are under growing pressure to innovate faster, reduce costs, and deliver highly customized machines without compromising quality or reliability. AI is emerging as a solution to help meet these goals. From streamlining mechanical design and improving production accuracy to supporting machine technicians with real-time information, machine builders are beginning to pilot AI across critical workflows. This paper examines how AI is being applied to meet the core priorities of machine builders.

AI is beginning to impact machine design, production planning, and service operations.
Survey data shows that machine builders are prioritizing use cases like predictive maintenance, AI-powered quality control, and simulation. Generative AI (GenAI) is also being piloted to support tasks like CAD automation and technician assistance. These use cases are helping reduce downtime, speed up design cycles, and improve customer responsiveness.

Getting started with AI requires data readiness, the right use cases, and upskilling.
Many companies are in the early stages of adoption, and the momentum is building. While challenges around legacy integration, cost, and workforce readiness remain, organizations are taking structured steps—focusing on business alignment, clean data foundations, cross-functional collaboration, and targeted training.

Microsoft

Key findings

1. **Reducing costs, accelerating innovation, and enhancing customization are top priorities for machine builders—and AI is being explored as a way to achieve them.**
   - **Top 3 main organizational priorities:** Machine builders are focusing on reducing operational costs (56%), driving product innovation (45%), and improving customization capabilities (31%).
   - **AI is a key enabler:** AI is expected to drive significant cost reductions, with respondents predicting savings in downtime (29%), production costs (21%), and maintenance (21%) in the next 2–3 years. Machine builders also expect to reduce iterative prototype cycles (37%) and achieve greater product customization (38%) by leveraging AI.

2. **AI adoption is still early, but companies are actively investing and piloting solutions across key operations.**
   - **Early-stage adoption with growing momentum.** While foundation technologies like smart sensors and ERP are already well established, most AI-based technologies have an adoption rate below 50%. However, companies are increasingly piloting AI-driven solutions.
   - **Key obstacles in adoption.** High costs (28%), complexity of integrating AI with legacy systems (17%), and insufficient data infrastructure (13%) are the most significant barriers companies face when it comes to AI adoption.

3. **AI is being considered across machine design, manufacturing, and service—with GenAI also poised for wider adoption.**
   - For machine design, respondents are in the trialing phase for AI use cases such as AI-driven component modeling (62%), AI-powered stress and fatigue simulation (69%), and AI-driven material selection and optimization (69%). CAD design generation is the most actively trialed GenAI use case (64%).
   - For machine manufacturing, respondents are in the trailing phase for AI use cases such as workflow automation with AI, AI-based machine vision systems, and AI for machine configuration and customization. The most adopted AI use case is predictive maintenance (65%).
   - In machine services and supply chains, respondents are in the trial phase for AI use cases such as AI-powered service workflow automation, AI-driven demand forecasting, and AI-based training and skill assessment tools. The most actively trialed GenAI use case is troubleshooting assistants (63%).

4. **Getting started with AI requires a structured approach: Machine builders are focusing on four foundational steps to unlock value from AI**
   1. **Identify the business need**
   2. **Improve data maturity**
   3. **Build cross-functional teams**
   4. **Enable workforce upskilling**

Scope of this report

This report focuses on companies that manufacture industrial machines used by other manufacturers. These include both full machine builders and producers of complex components critical to machine functionality. The scope excludes makers of small or generic parts such as sensors or circuit boards.

Machine builder segments covered in this report:

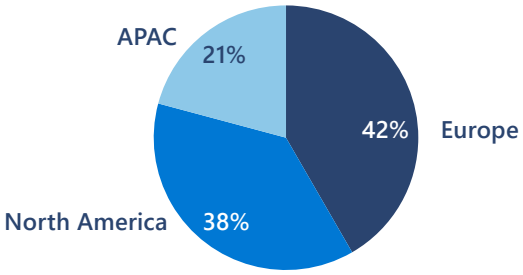
1. **CNC machines**
2. **Semiconductor manufacturing equipment**
3. **Turbines and industrial engines**
4. **Robotics and automation equipment**
5. **Bottling and packaging systems**
6. **Agricultural and forestry machinery**
7. **Construction and mining equipment**
8. **Food and beverage processing machinery**
9. **Material handling and lifting equipment**
10. **Heavy industrial energy machinery (e.g., generators, fluid power systems)**

About the data: Survey of 120 executives in the industrial machine manufacturing industry

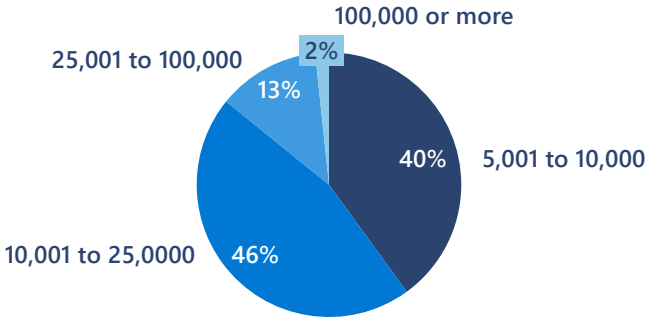
Overview of participants (N = 120)

Respondent sampling overview

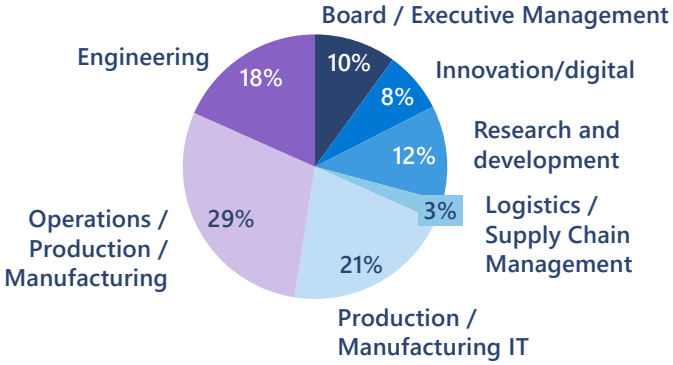
Region



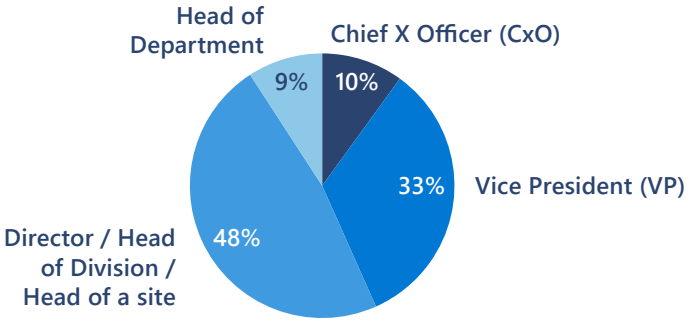
Size (no. of employees)



Department



Seniority



Microsoft

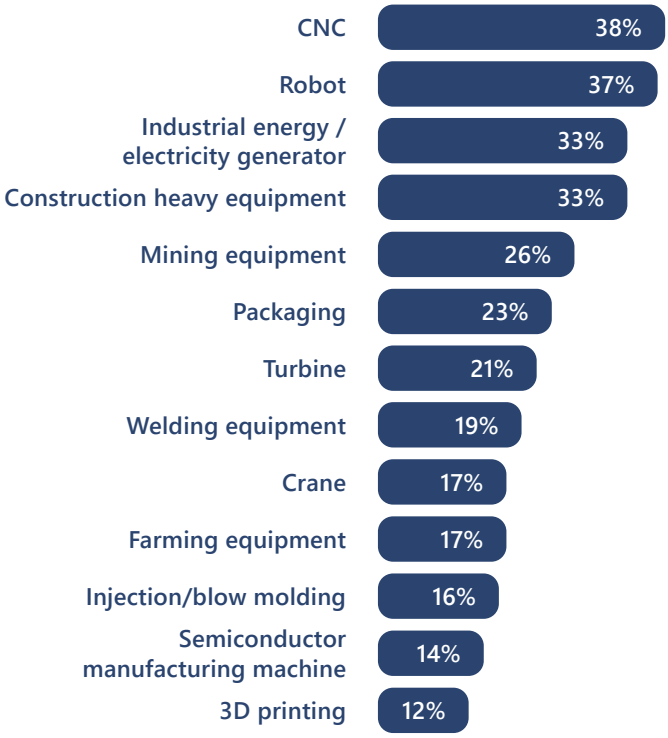
About the data: Survey of 120 executives in the industrial machine manufacturing industry

Overview of participants (N = 120)

Respondent characteristics

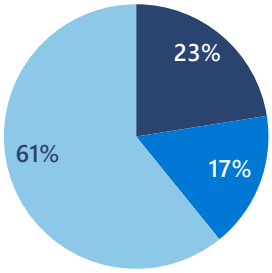
Manufactured machinery types

Share of plants that manufacture the respective machinery type



Standardized vs. customized machines

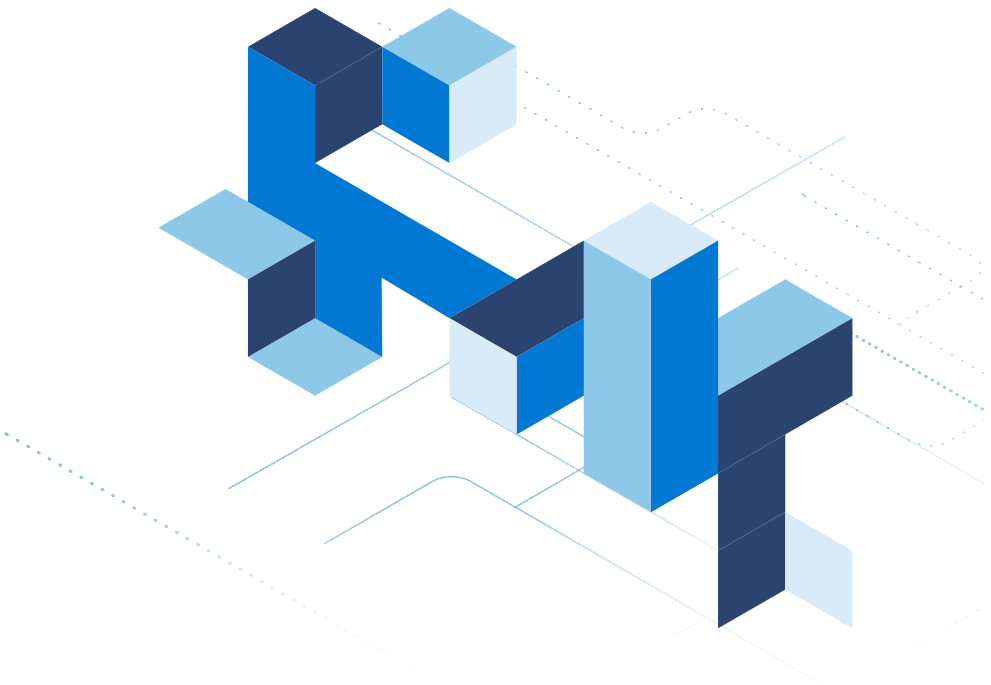
Share of respondents based on whether they manufacture standardized or customized machines



- We primarily produce standardized machines with minimal customization and follow an assembly line process.
- We primarily manufacture custom machines based on client specifications and build them in-place at a stationary location.
- We handle both custom and standardized models, depending on the order, and may use either an assembly line or in-place building method.

Microsoft

Table of contents



Microsoft

Methodology

Microsoft developed this document in close collaboration with IoT Analytics, a boutique market research company focusing on IoT, AI, the cloud, edge technology, and Industry 4.0.

The centerpiece of this research is a survey conducted between February and April 2025 with 120 respondents working in machine builder industries worldwide. The respondents are key stakeholders in design, manufacturing, and operations, furthering their organizations' technology/digital initiatives. The survey sample includes companies manufacturing complex equipment such as CNC machines, turbines, semiconductor tools, robotics, bottling systems, and heavy equipment. The participants represent a mix of machine types and organizational functions, including R&D, IT, and operations, with most holding senior leadership roles. Geographically, respondents are distributed across Europe, North America, and Asia-Pacific. Company sizes range from mid-sized manufacturers to large multinational enterprises.

1 Current state of AI adoption

The current state of AI adoption in machine building

Machine builders are at the beginning of their AI journey, building on a mix of established digital systems such as ERP, PLM, and smart sensors. While these foundational technologies are already in place, AI adoption is emerging with most companies in the pilot or exploration phase.

Top business priorities today include reducing operational costs, accelerating product innovation, and enabling greater customization. AI is being trialed to support these goals through use cases like quality control, predictive maintenance, and design automation. Companies see strong potential for AI to reduce downtime, optimize production, and improve engineering workflows. However, challenges around cost, legacy integration, and digital maturity continue to shape the pace of adoption.

Microsoft

Top organizational priorities

Cost, innovation, and customization are top priorities for the machine building industry.

As machine builders navigate their way in a competitive and dynamic market, their digital and AI strategies are being shaped around key priorities like reducing operational costs (56%), driving product innovation (45%), enhancing customization capabilities (31%), improving workforce efficiency (31%), and improving production visibility (30%). These priorities reflect a dual focus: streamlining internal operations while responding to increasing customer expectations for agility and tailored machines.

Exhibit 1: Top organizational priorities of the machine building industry

Reducing operational costs, product innovation, and customization are the most cited business goals.

Share of respondents who pointed to the respective topic as a "top" or "significant" priority in their organization's drive to transform its industrial operations over the next 3-5 years.

Question: To what extent are the following a priority in your organization's drive to transform its industrial operations over the next 3-5 years?

How these priorities show up in practice

Optimizing operational costs. 56% of respondents identified cost reduction as a top organizational priority. This focus is driven by the need to optimize direct and indirect costs—ranging from raw material usage and energy consumption to labor productivity and machine uptime.

> "Cost is always a major consideration, whether it's through reducing rework, improving assembly accuracy, or shortening development cycles. That's where AI is starting to make a real difference."
>
> —Director, Digital Manufacturing Engineering at a leading agriculture machinery manufacturer

> "Reducing operational cost is one of our top three priorities—but in our segment, speed and responsiveness to customer changes matter just as much, if not more."
>
> —VP of Global Manufacturing Operations at a leading semiconductor equipment manufacturer

Driving product innovation. 43% of respondents cite product innovation as a core priority. Instead of incremental changes, machine builders are looking to differentiate their offerings. Companies are leveraging technologies to accelerate the development of innovative products that anticipate customer needs.

> "We are continuously innovating in terms of product features, controls, automation, and integration with newer technologies—this helps us stay competitive and deliver more value to the customer."
>
> —Director, Digital Manufacturing Engineering at a leading agriculture machinery manufacturer

Improving customization capabilities. 34% of companies highlight customization as a key priority. As customer demand for tailored solutions grows, manufacturers are investing in flexible processes that allow for greater product design and production adaptability while maintaining efficiency and quality.

"Time to market and flexibility are essential in a high-mix, low-volume environment like ours—machines need to be ready fast, even when configurations change last minute."

—VP of Global Manufacturing Operations at a leading semiconductor equipment manufacturer

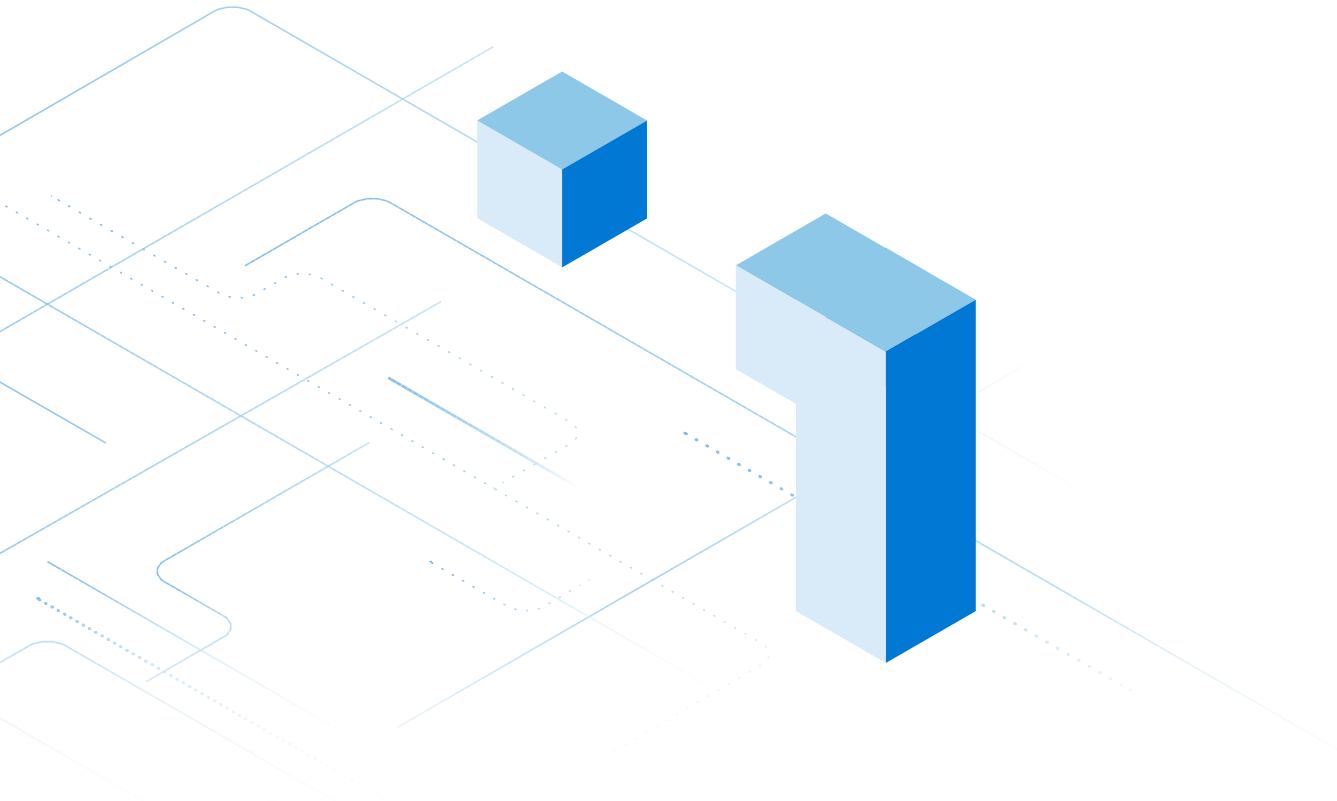
A deeper look into organizational priorities by machine type:

1. **Optimizing operational cost.** Mining (68%), farming (67%), and robot (62%) manufacturers emphasize cost optimization the most.
2. **Driving product innovation.** Robot (59%), injection/blow molding (53%), and packaging (40%) equipment manufacturers prioritize innovation more than others.
3. **Improving customization capabilities.** Packaging (48%), welding (46%), and CNC (42%) equipment manufacturers highlight customization as a key priority.

Impact of tariffs on organizational priorities.

The survey for this paper was completed before April 2, 2025, when large-scale tariffs were announced by the US government. As a result, the paper does not address the potential effects of these tariffs on the machine builder industry. However, discussions with industry experts confirm that tariffs are expected to influence supply chain strategies significantly. Machine builders will need to reassess where they source components and may consider relocating or establishing new production facilities in response.

> "Tariffs are a major issue, and big players are thinking of relocating their production facilities or opening new facilities inside the US. Companies are being forced to be very careful with their supply chain decisions—where components are made and ensuring they go through the right channels."
>
> **—Technical director at a leading energy equipment manufacturer in the U.S.**



Technology and AI adoption

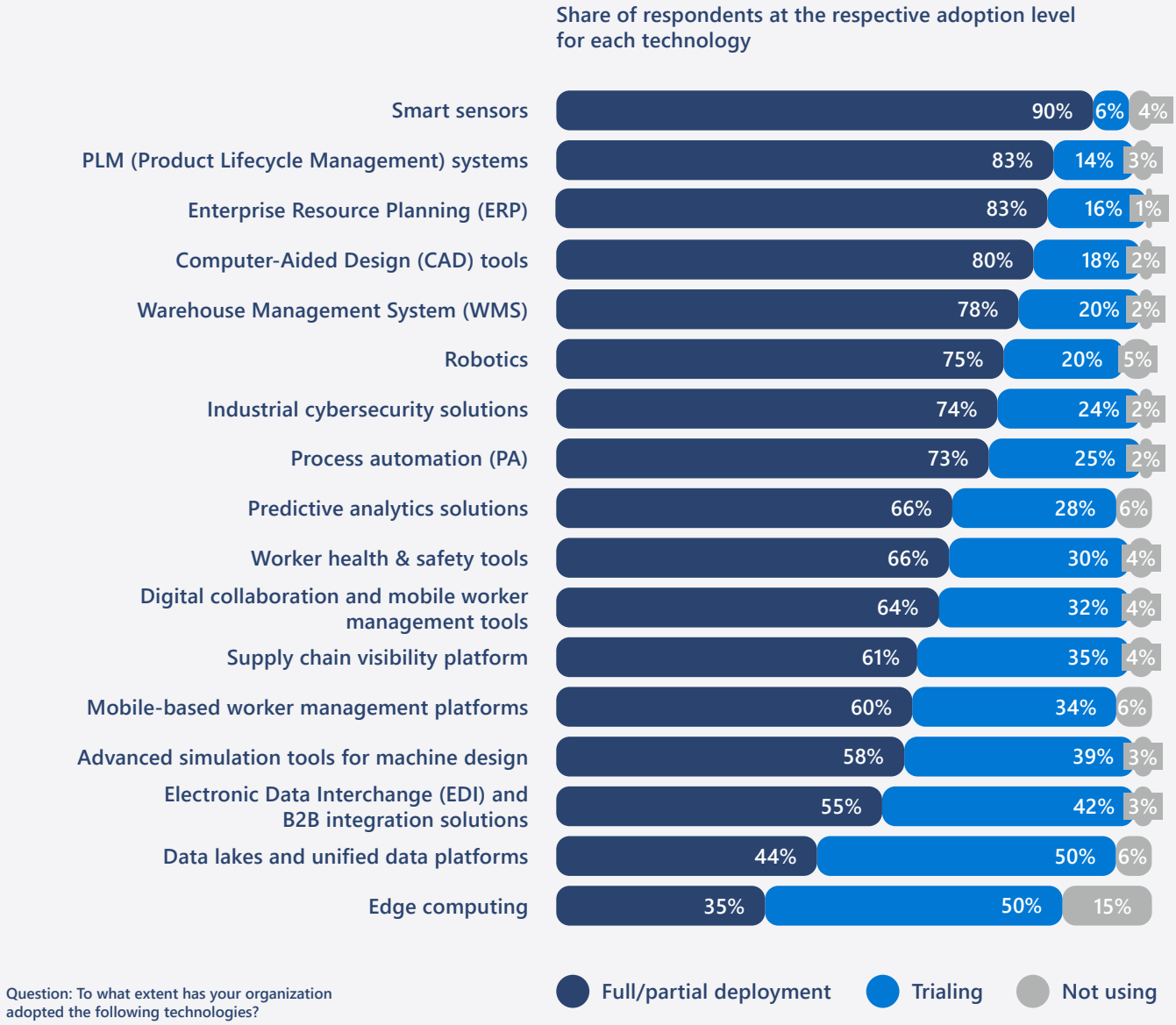
AI is witnessing growing pilot activity in the machine-building industry.

While most AI technologies are in the early phases of adoption, the momentum toward AI-driven transformation is building. Companies are actively laying the groundwork for AI adoption—they are piloting and experimenting with use cases across the machine lifecycle. Established technologies like smart sensors (90%) and PLM systems (83%) are already widely adopted, forming the digital foundation for more advanced capabilities. Among AI-specific technologies, AI-powered quality control systems (49%) and AI-driven process optimization in R&D (48%) are currently the most adopted, signaling where companies see early value.

Microsoft

Exhibit 2: Technology Adoption – Established Technologies

Smart sensors, PLM, and ERP are the most widely adopted technologies.



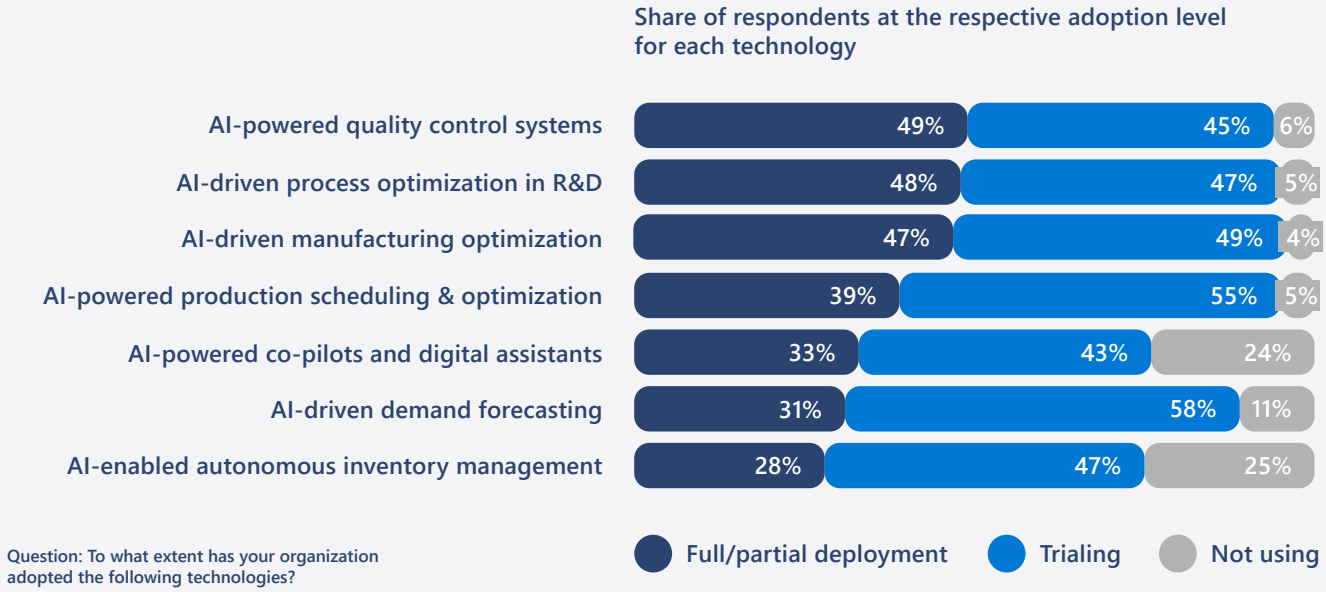
Question: To what extent has your organization adopted the following technologies?

The widespread adoption of foundational technologies like ERP, PLM, and smart sensors reflects years of digital investment focused on standardizing core operations. Unlike AI, these technologies have matured over time and are now seen as essential infrastructure, often serving as prerequisites for more advanced capabilities. Their high adoption rates also suggest that many machine builders are well-positioned to begin layering AI on top of these digital systems.

Microsoft

Exhibit 3: Technology Adoption- AI technologies

AI-powered quality control systems, process optimization, and manufacturing optimization are the most widely adopted AI technologies.



Question: To what extent has your organization adopted the following technologies?

Survey results show that adoption rates for AI use cases remain below 50% across the board, in contrast to foundational technologies like ERP or PLM, which are well-established. However, the low rollout numbers do not reflect disinterest—they highlight a strategic and measured approach. Most machine builders are focused on understanding where AI can add the most value before committing to full-scale deployment.

"Many of the AI initiatives are still in development—we're prioritizing what to tackle first and moving forward step by step."

—Director, Digital Manufacturing Engineering at a leading agriculture machinery manufacturer

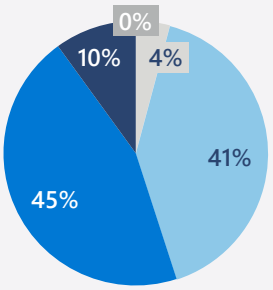
"We've been working on this AI initiative for nearly four years. The focus has been to digitize first, then gradually introduce intelligence—starting small and expanding from there."

—VP Global Manufacturing Operations at a leading semiconductor equipment manufacturer

Exhibit 4: AI adoption level

Most organizations are in the pilot or scaling phase of AI adoption

Share of organizations who are in the respective stage of AI adoption



- Not using AI today
- In the planning stage, focused on data readiness and infrastructure
- Piloting AI solutions with targeted proof-of-concepts (POCs)
- Scaling AI solutions across our operations or various sites
- Scaling AI across our entire enterprise

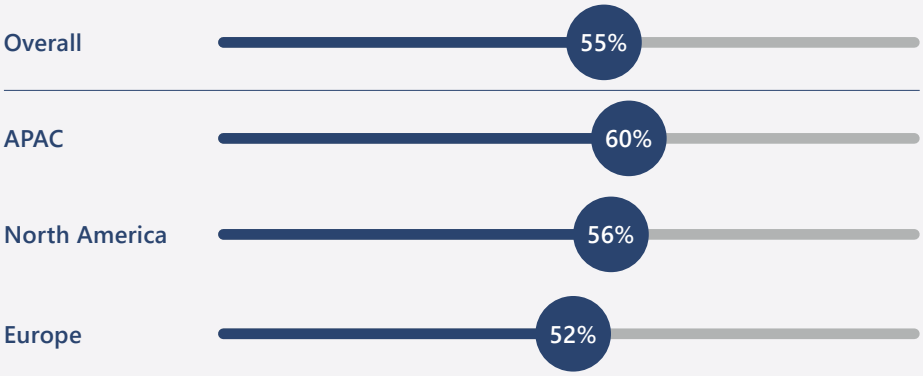
Question: How far along is your organization in adopting AI within its operations?

45% of respondents are scaling AI across operations or various sites, while 41% are piloting AI solutions with targeted proof-of-concepts. 10% of respondents are in the planning stage, focussing on data readiness and infrastructure, and 4% are not using AI today.

Exhibit 5: AI adoption split by region

AI adoption is slightly more advanced in APAC than in North America and Europe.

Share of respondents in each region who are either scaling AI across their entire enterprise or operations/various sites.



Question: How far along is your organization in adopting AI within its operations?

APAC leads in AI adoption, with 60% of organizations there scaling AI—44% across operations or multiple sites and 16% across the entire enterprise. North America follows at 55% (42% across operations, 13% enterprise-wide), while Europe is at 52% (48% across operations, 4% enterprise-wide).

Microsoft

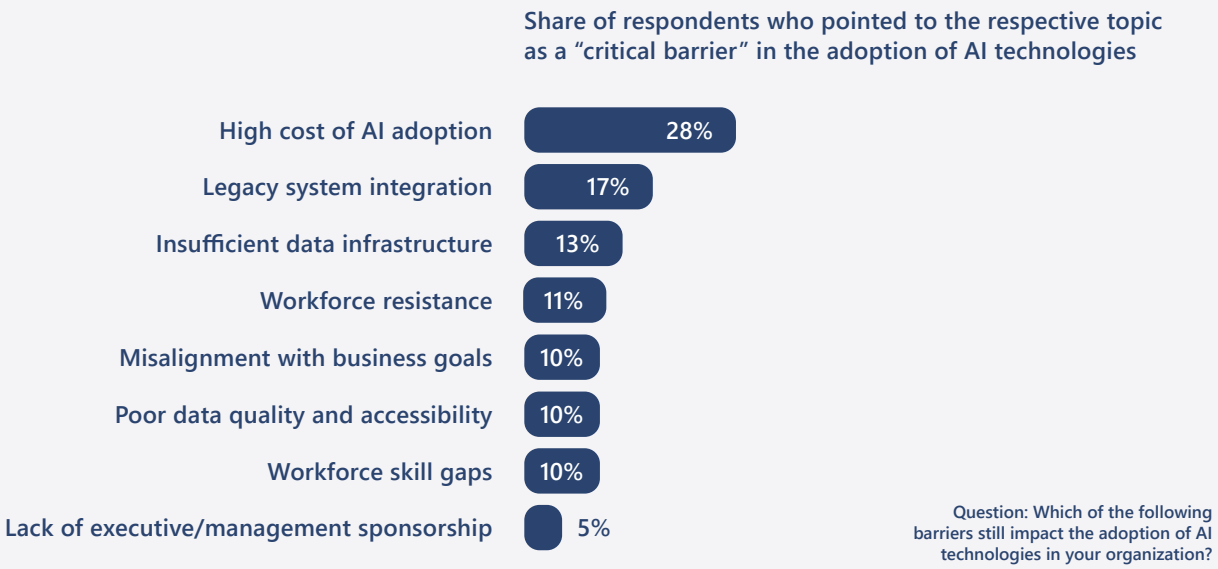
Top barriers slowing down AI adoption

Cost, data infrastructure, and integration complexity are key adoption hurdles.

Despite growing interest and experimentation with AI, machine builders face three key hurdles in their adoption journey: the cost of AI implementation (29%), the difficulty of integrating AI solutions into legacy systems (17%), and insufficient data infrastructure (13%). These barriers are not only technical but also organizational, often requiring investment in foundational systems, process redesign, and workforce readiness.

Exhibit 6: Top barriers to AI adoption

Cost, integration complexity, and workforce readiness are the top challenges to scaling AI.



Microsoft

Why these barriers matter

The cost of implementation remains a gating factor. 29% of respondents identify high costs as the most significant challenge to AI adoption. These costs span software licenses, cloud infrastructure, AI/ML engineering talent, and the time required for custom solution development. For many firms, proving near-term ROI is essential before scaling efforts can continue.

> "The high upfront investments required for AI, including costs for training, cloud infrastructure, and other resources, are a significant concern. Many organizations worry about the return on investment (ROI) and the uncertainty around it, with management questioning whether the benefits will justify the costs."
>
> —Technical director at a leading energy equipment manufacturer in the U.S.

System integration is a technical and organizational challenge. 17% of companies cite the complexity of integrating AI with legacy systems as a core obstacle. Machine builders often operate with long-lived PLCs, custom control systems, and fragmented IT/OT architectures. Integrating AI requires more than just APIs—it usually involves rethinking data flows, control hierarchies, and security layers.

> "For AI to work on the factory floor, we had to bridge systems that weren't originally built to talk to each other. Our MES vendor and vision system vendor had to collaborate closely to create an integration layer that worked across both platforms. These systems weren't designed with AI in mind, so aligning data formats, interfaces, and timing was a real hurdle."
>
> —Director, Digital Manufacturing Engineering at a leading agriculture machinery manufacturer

Data infrastructure remains a foundational gap. 13% of respondents cite insufficient data infrastructure as a key barrier to AI adoption. For many machine builders, the underlying data architecture is not yet mature enough to support AI at scale. Inconsistent data models, siloed systems, and limited real-time visibility make training and deploying reliable AI models difficult. Without clean, accessible, and timely data, even well-designed AI use cases struggle to deliver value.

> "We spent a lot of time preparing data for AI because much of it was either unused or not ready for analysis. A lot of valuable data was stored in historians but wasn't being leveraged effectively. Identifying patterns in the data often started with manual reviews by engineers, making the entire process slow and inconsistent."
>
> —Technical director at a leading energy equipment manufacturer in the U.S.

A deeper look into barriers by the size of the machine builder:

1. **Very large (25,000+ employees):** Legacy system integration (41%) and data quality (24%) are the top barriers.
2. **Large (10,000–25,000 employees):** High cost of adoption (62%) and insufficient data infrastructure (47%) are the most cited barriers.
3. **Medium (5,000–10,000 employees):** Poor data quality (59%) and high cost of adoption (57%) stand out.

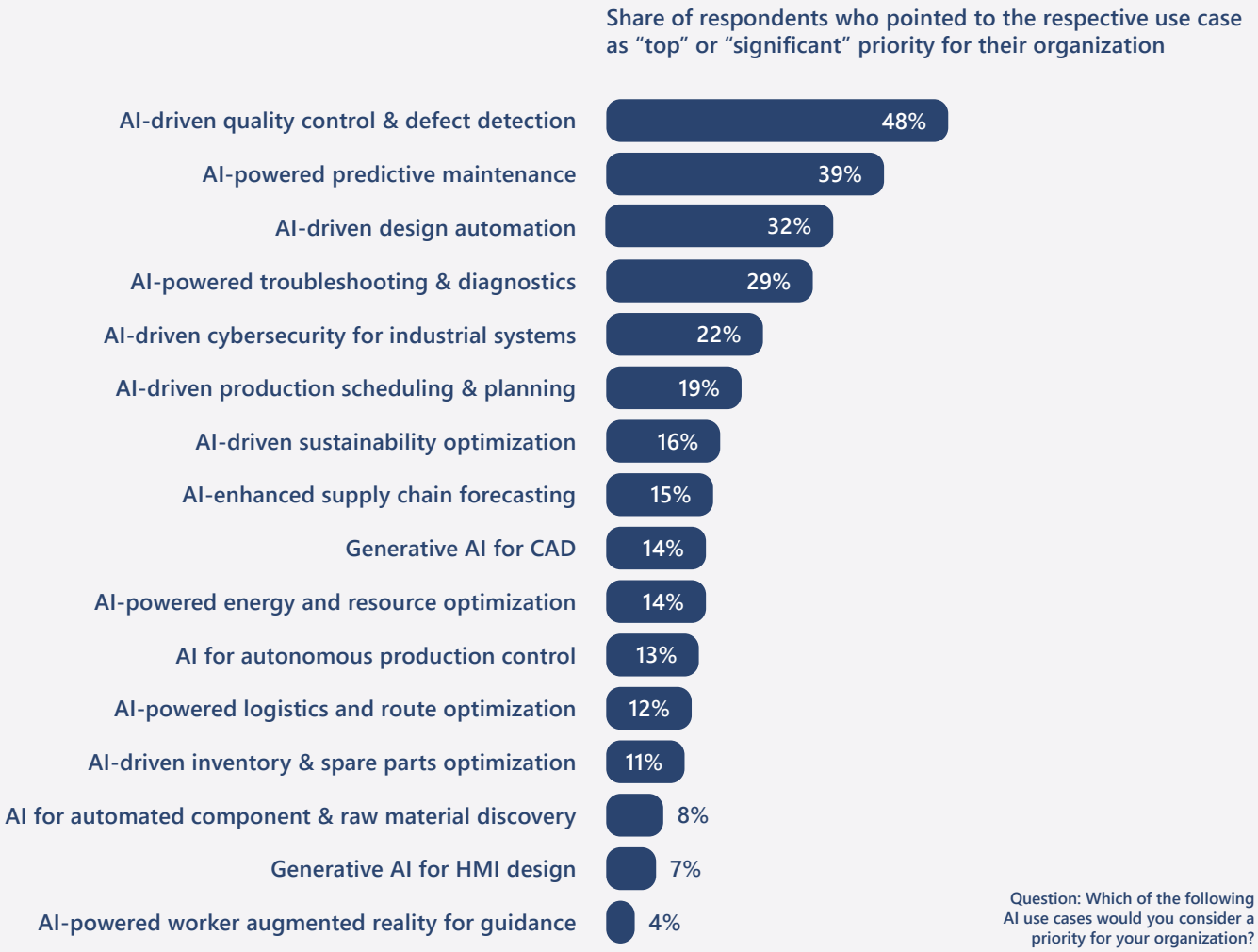
Top AI use cases

The machine building industry is prioritizing AI for several design and manufacturing use cases.

Machine builders are focusing their AI efforts on a set of high-impact use cases that closely align with their top organizational priorities. The most commonly prioritized use cases are AI-based quality control (48%), predictive maintenance (39%), and design automation (32%)—each directly supporting goals like reducing operational costs, accelerating innovation, and enabling greater customization.

Exhibit 7: Most prioritized AI use cases

Quality control, predictive maintenance, and design automation are the top focus areas.



Microsoft

Why these use cases are leading

AI-based quality control supports cost reduction and reliability. 48% of respondents are prioritizing machine vision systems to automate inspection tasks. These tools help reduce rework, improve first-pass yield, and ensure consistent product quality—contributing directly to lower operational costs and fewer warranty claims.

Predictive maintenance improves uptime and service efficiency. 39% of companies highlight predictive maintenance as a key AI focus. By identifying potential equipment failures before they happen, this use case helps avoid costly unplanned downtime and extends machine life, supporting cost-efficiency and reliability for customers.

Design automation accelerates innovation and enables customization. 32% of respondents are prioritizing AI to assist in tasks like CAD generation, component configuration, and simulation. These capabilities help speed up product development and make it easier to deliver tailored machines without increasing engineering effort.

> "We have implemented certain AI use cases, such as vision-based quality control, for years, even before the recent AI boom of the past 2–3 years. However, with advancements in algorithms, we are now seeing much greater value from these use cases as the tools continue to improve."
>
> —Technical director at a leading energy equipment manufacturer in the U.S.

> "We've chosen to start where we see clear, measurable value—like quality inspection, predictive maintenance, and simulation. These are areas where the ROI is more straightforward, and the outcomes are easier to track."
>
> —Director, Digital Manufacturing Engineering at a leading agriculture machinery manufacturer

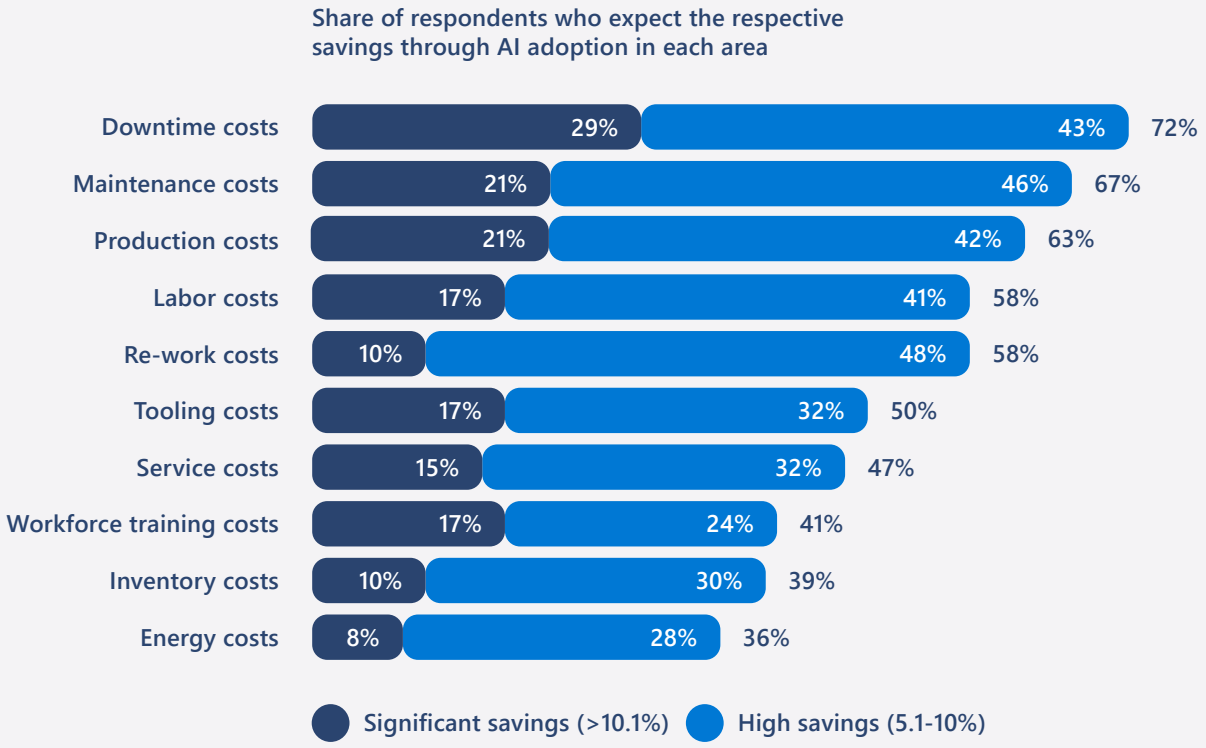
Cost savings potential through AI

AI is expected to deliver high cost savings in downtime, maintenance, and production areas.

One of the most important outcomes machine builders expect from AI is tangible cost savings. Over the next two to three years, survey respondents anticipate measurable reductions across three key areas: downtime costs (73%), maintenance costs (67%), and production costs (64%).

Exhibit 8: Expected cost savings from AI by category

Machine builders expect AI to reduce downtime, production, and maintenance costs.



Question: Where does your organization expect to achieve the most cost savings through AI adoption in the next 2-3 years?

A deeper look into cost-saving expectations by machine builder type:

1. **Custom machine builders:** Expect higher savings in maintenance (76%), production costs (76%), and labor (71%).
2. **Hybrid (standard + custom) machine builders:** Expect higher savings in downtime (73%) and maintenance (69%) optimization.
3. **Standardized machine builders:** Prioritize savings in downtime (74%) and re-work costs (69%).

These areas reflect some of the most cost-intensive aspects of machine builder operations, and they directly tie back to the top organizational priority of reducing operational costs. As companies explore AI, they remain optimistic about scaling solutions that drive efficiency and improve margins.

"We're already seeing 20–30% improvement in areas like defect reduction and quality tracking. As we continue scaling our AI initiatives, we believe similar levels of cost savings, 20–30%, are realistic in other key areas over the next few years."

—Director, Digital Manufacturing Engineering at a leading agriculture machinery manufacturer

"We have long recognized the value of demand forecasting, especially for optimizing our inventory levels. The management is fully convinced that using AI in this area will lead to substantial inventory cost savings, even though we haven't yet put a specific number to those savings."

—Technical director at a leading energy equipment manufacturer in the U.S.

"In our environment, AI doesn't reduce shop floor roles, but it significantly cuts down indirect overhead like planners and project managers. Most of what these roles do is just collecting and re-sharing information manually, AI and automation are replacing that completely."

—VP Global Manufacturing Operations at a leading semiconductor equipment manufacturer

2 AI in the machinery value chain

AI is gaining traction across design, manufacturing, and operations

Machine builders are integrating AI into key phases of the machine lifecycle—design, manufacturing, and operations. While adoption is still emerging, expectations are high for AI to improve speed, efficiency, and quality across these domains. In design and engineering, companies see AI helping manage growing data complexity, accelerate simulations, and support machine customization. In manufacturing, AI is already being adopted to reduce downtime and improve quality through predictive maintenance and vision-based inspection. In operations, AI is being used to enhance technician effectiveness, support remote diagnostics, and improve demand forecasting.

Both traditional AI and GenAI are being actively piloted. GenAI is being tested in several areas such as CAD design generation, technician training, and troubleshooting assistance. Across the board, these use cases are closely aligned with business outcomes—enabling faster development cycles, more reliable production, and improved customer service.

AI is shaping key phases of the machinery value chain

AI is influencing how machine builders approach each part of their value chain. Three key phases, as outlined below, form the core of this value value chain.

3 key phases of the machinery value chain

Design:

Covers the development of virtual prototypes, performance simulation, and creation of design assets such as CAD models and component specifications

Build:

Includes the manufacturing and assembly of machines, along with quality checks and production planning

Operate:

Focuses on keeping machines running efficiently through maintenance activities, service support, and timely availability of parts via supply chain coordination

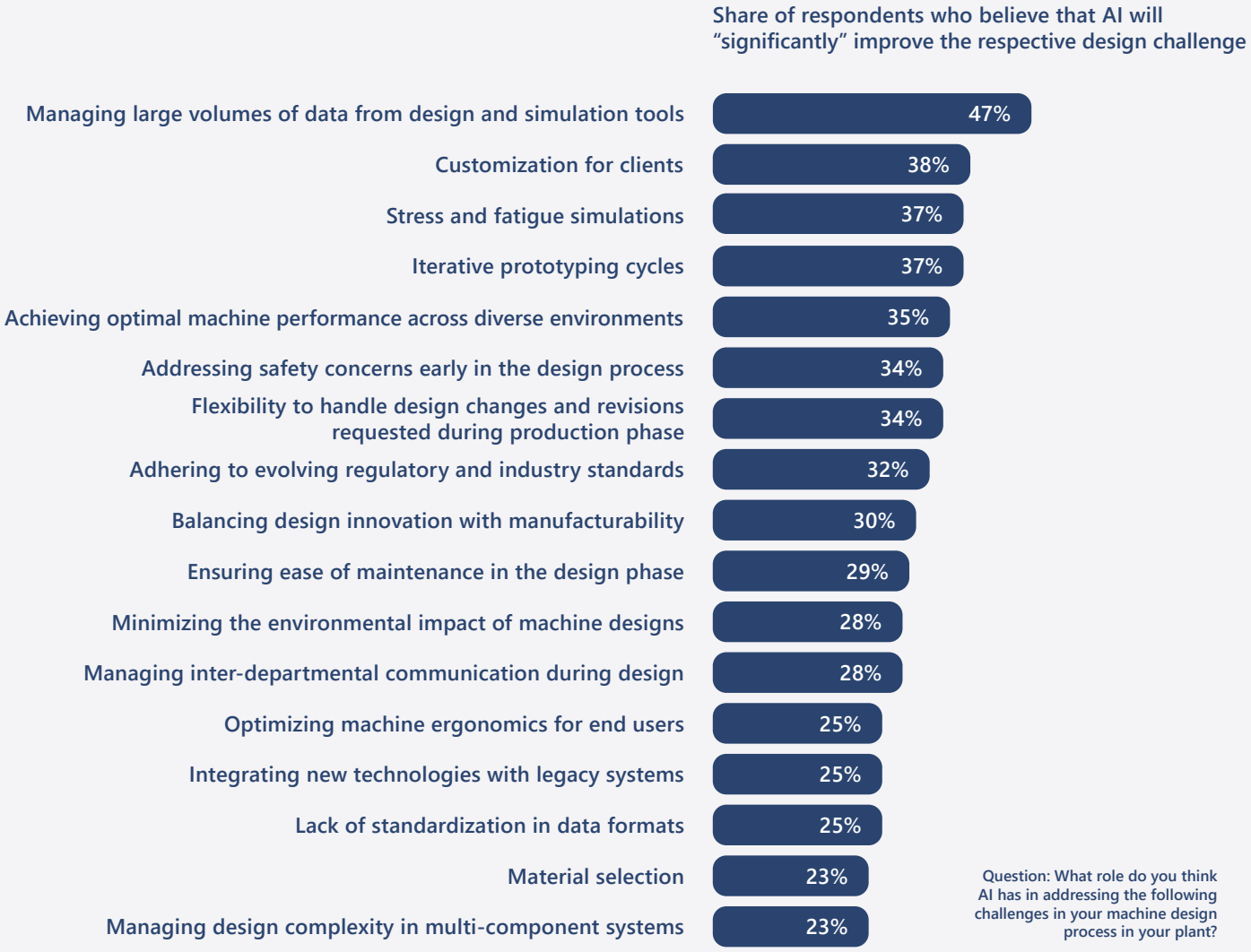
The role of AI in machine design, engineering, and development

Design | Build | Operate

Machine builders see significant potential for AI to improve how machines are designed, engineered, and developed. With growing complexity in both design requirements and customer expectations, AI is expected to help companies manage challenges such as large data volumes (47 %) and customization (38 %) and optimize stress and fatigue simulations (37 %).

Exhibit 9: Where AI is expected to deliver the most value in design and engineering

AI is expected to improve data management and support customization.



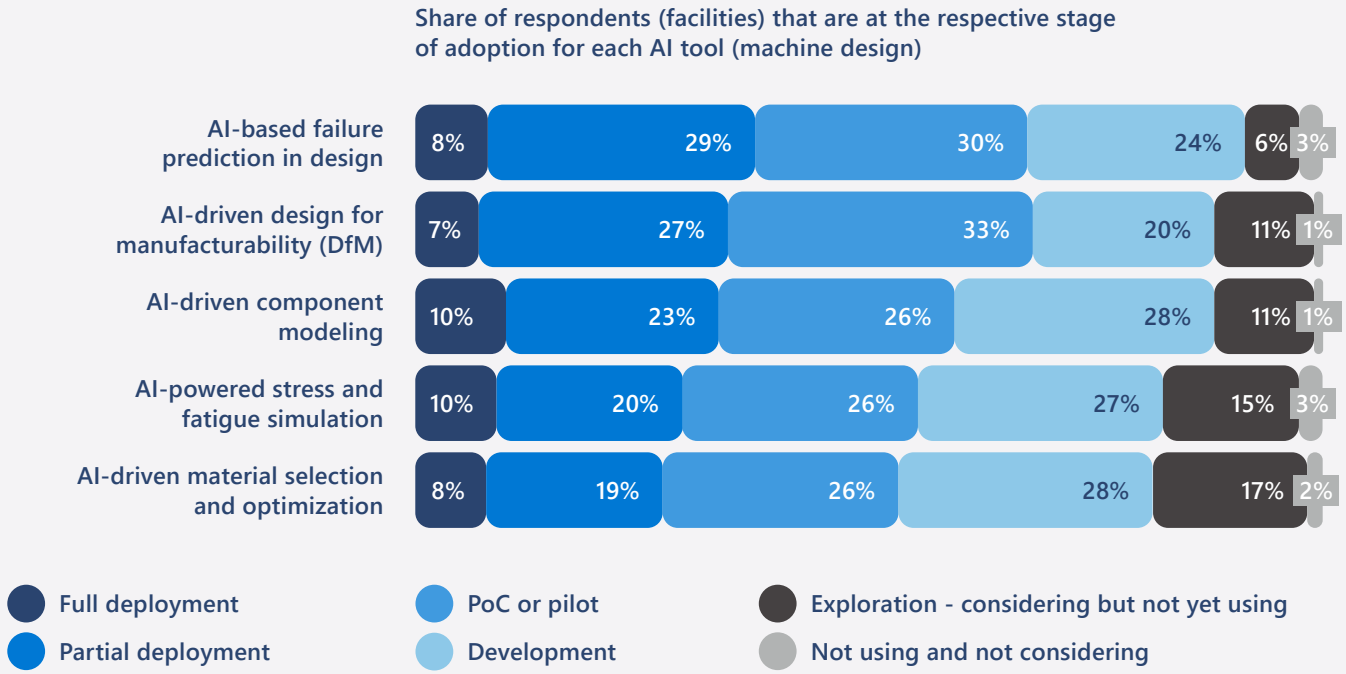
Where the machine building industry expects AI to deliver the most impact in design and engineering

Managing large volumes of data. 47% of respondents believe AI will greatly enhance the processing of large volume of design and simulation data, especially for complex machines with varied configurations, performance needs, and compliance requirements.

Enabling greater machine customization. 38% of respondents expect AI to improve machine customization during design, helping efficiently configure and validate variants to meet specific customer needs.

Exhibit 10: Top AI use cases being trialed and deployed in design and engineering

Failure prediction, design for manufacturability, and component modeling are the top AI use cases gaining traction.



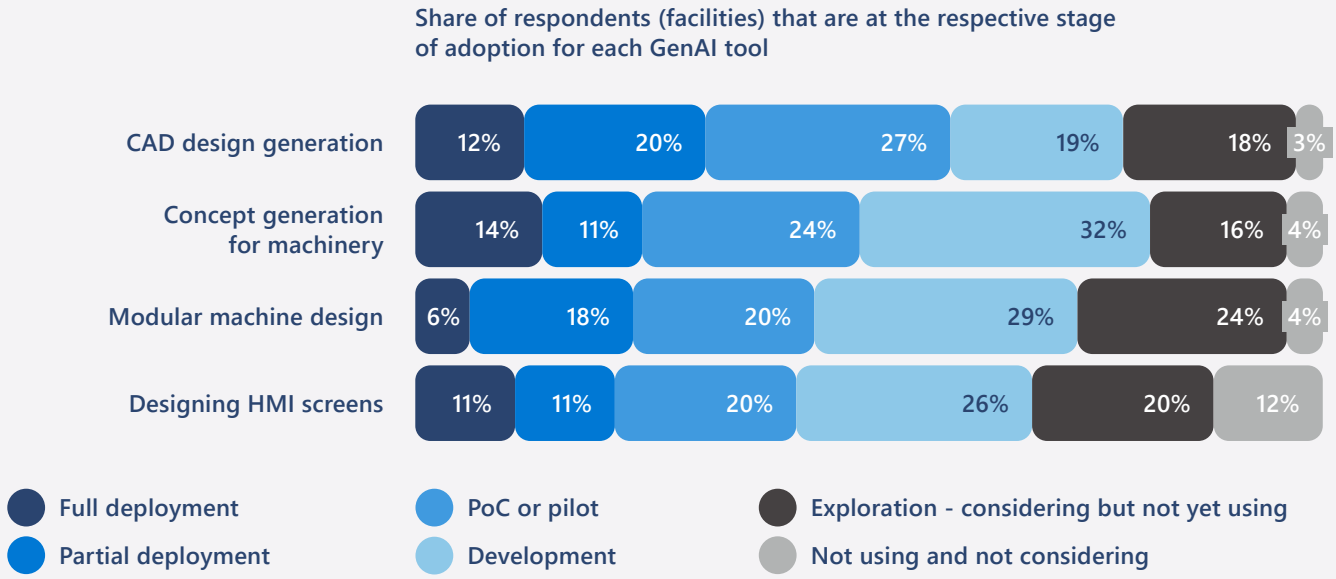
Question: At what stage is your facility(ies) in adopting the following AI tools in your machine design process?

AI adoption in design and engineering.

Several use cases of AI in design and engineering are gaining traction. The top use cases include AI-based failure prediction in design (37% deployed/54% trialing), AI-driven design for manufacturability (34% deployed/53% trialing), and AI-driven component modeling (33% deployed/54% trialing). Implementing these use cases helps simulate and detect failure scenarios early, optimize designs for easier and more cost-effective manufacturing, and automate modeling tasks to speed up development and enable component reuse across product variants.

Exhibit 11: Top GenAI use cases being trialed and deployed in design and engineering

CAD design generation is the most actively piloted GenAI use case in early-stage engineering workflows.



Question: At what stage is your plant in adopting GenAI for the following machine design use cases?

GenAI adoption in design and engineering.

GenAI is also starting to influence design generation, particularly during the concept development phase. One use case seeing early momentum is GenAI for CAD design generation (32% deployed/46% trialing). This GenAI use case allows engineers to generate design layouts or concepts using text prompts or rules, supporting rapid exploration in early-stage design.

"In turbine blade design, GenAI has helped us generate and evaluate new concepts, especially during early-stage development. We are using AI-driven topology optimization to maximize durability and refine features like vane passages. Accelerated simulations let us test design changes and predict potential failure points much faster than before."

—Technical director at a leading energy equipment manufacturer in the U.S.

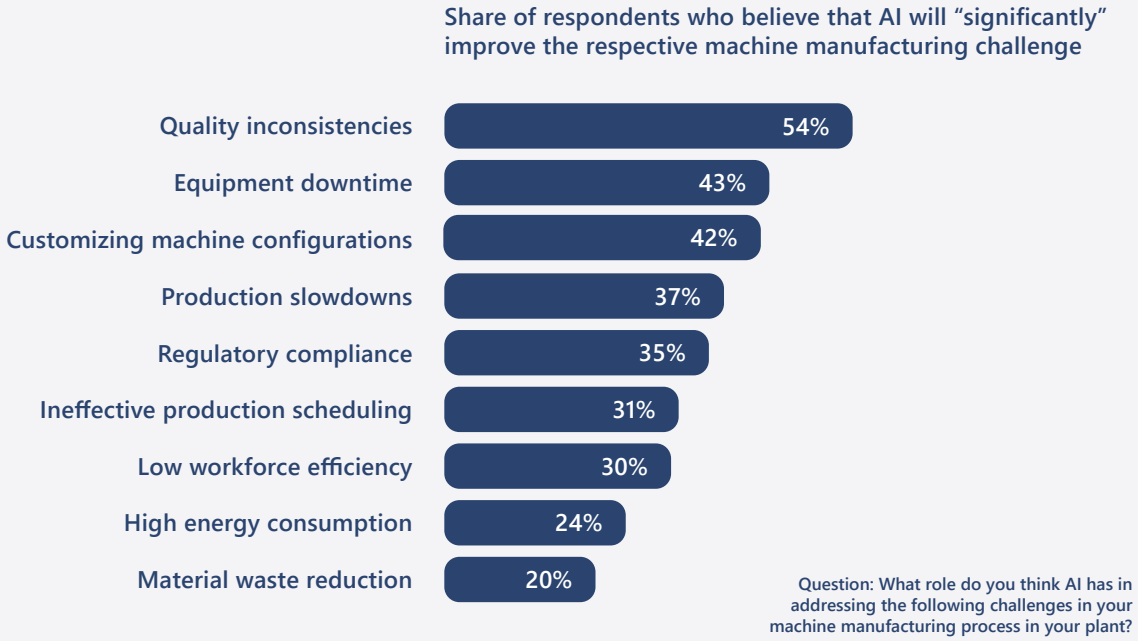
The role of AI in machine manufacturing

Design | **Build** | Operate

Machine builders are turning to AI to address key challenges in manufacturing operations, particularly in improving quality and reducing equipment downtime. 54% of respondents believe AI will significantly enhance how quality issues are detected and resolved, while 43% expect AI to reduce equipment downtime by predicting failures and optimizing maintenance schedules. Key AI use cases in manufacturing include predictive maintenance systems (54% deployed), workflow automation (37% deployed), and AI-based machine vision systems (35% deployed).

Exhibit 12: Where AI is expected to deliver the most value in manufacturing

AI is expected to reduce downtime, enhance quality control, and enhance customization.



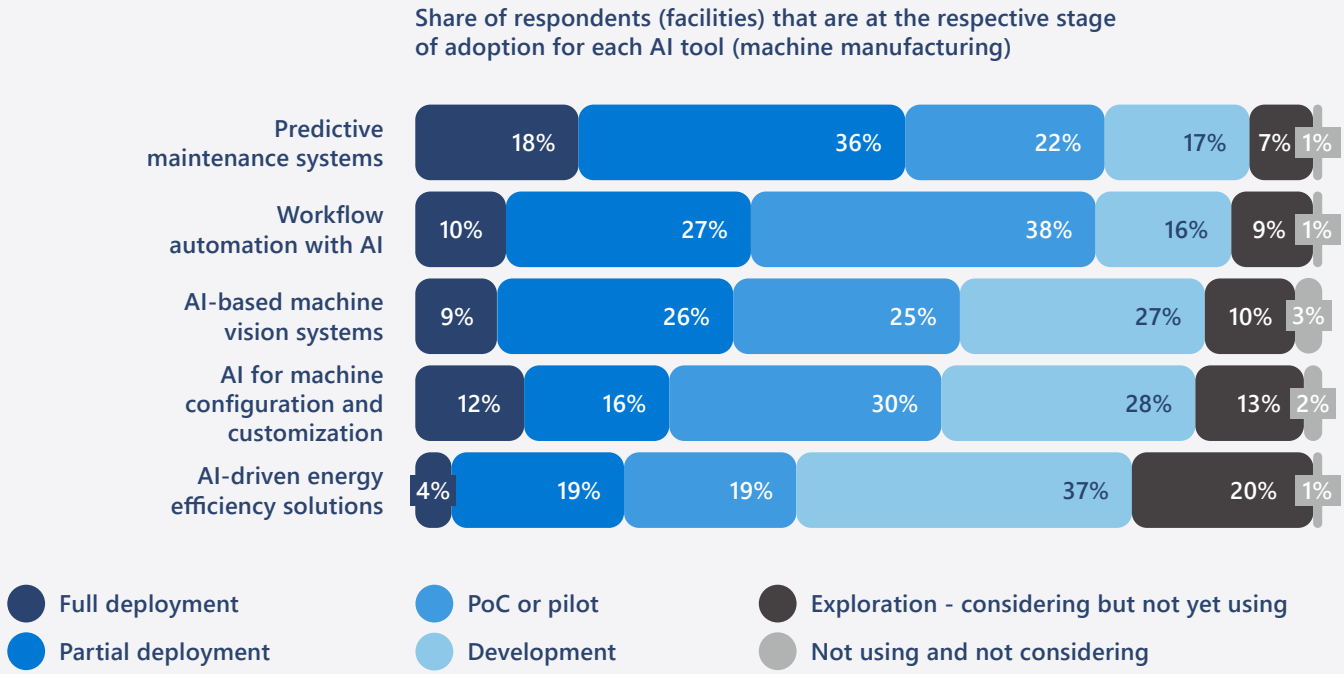
Where the machine building industry expects AI to deliver the most impact in machine manufacturing

Improving quality inconsistencies. 54% of respondents believe AI will significantly improve how quality issues are detected and addressed during manufacturing. AI-powered vision systems and anomaly detection algorithms are seen as enablers of faster, more accurate inspection.

Reducing equipment downtime. 43% of companies expect AI to reduce equipment downtime significantly. This includes using predictive models to foresee failures, optimize maintenance schedules, and increase overall equipment effectiveness.

Exhibit 13: Top AI use cases being trialed and deployed in manufacturing

Predictive maintenance, workflow automation, and machine vision systems lead in adoption and trial activity.



Question: At what stage is your plant in adopting the following AI tools in your machine manufacturing process?

Current AI adoption and trial activity in manufacturing operations

The top AI use cases in machine manufacturing include predictive maintenance systems (54% deployed/39% trialing), workflow automation with AI (37% deployed/54% trialing), and AI-based machine vision systems (35% deployed/52% trialing). These systems help reduce unplanned downtime, improve line efficiency, and enhance quality control through automated inspection and anomaly detection.

"AI is starting to make a difference in manufacturing. Predictive quality control and analysis of sensor data from CNC machines have improved our processes. Routine tasks like generating or updating CNC machine code are now assisted by chatbots, and anomaly detection has become more efficient, helping us identify issues earlier and reduce errors."

—Technical director at a leading energy equipment manufacturer in the U.S.

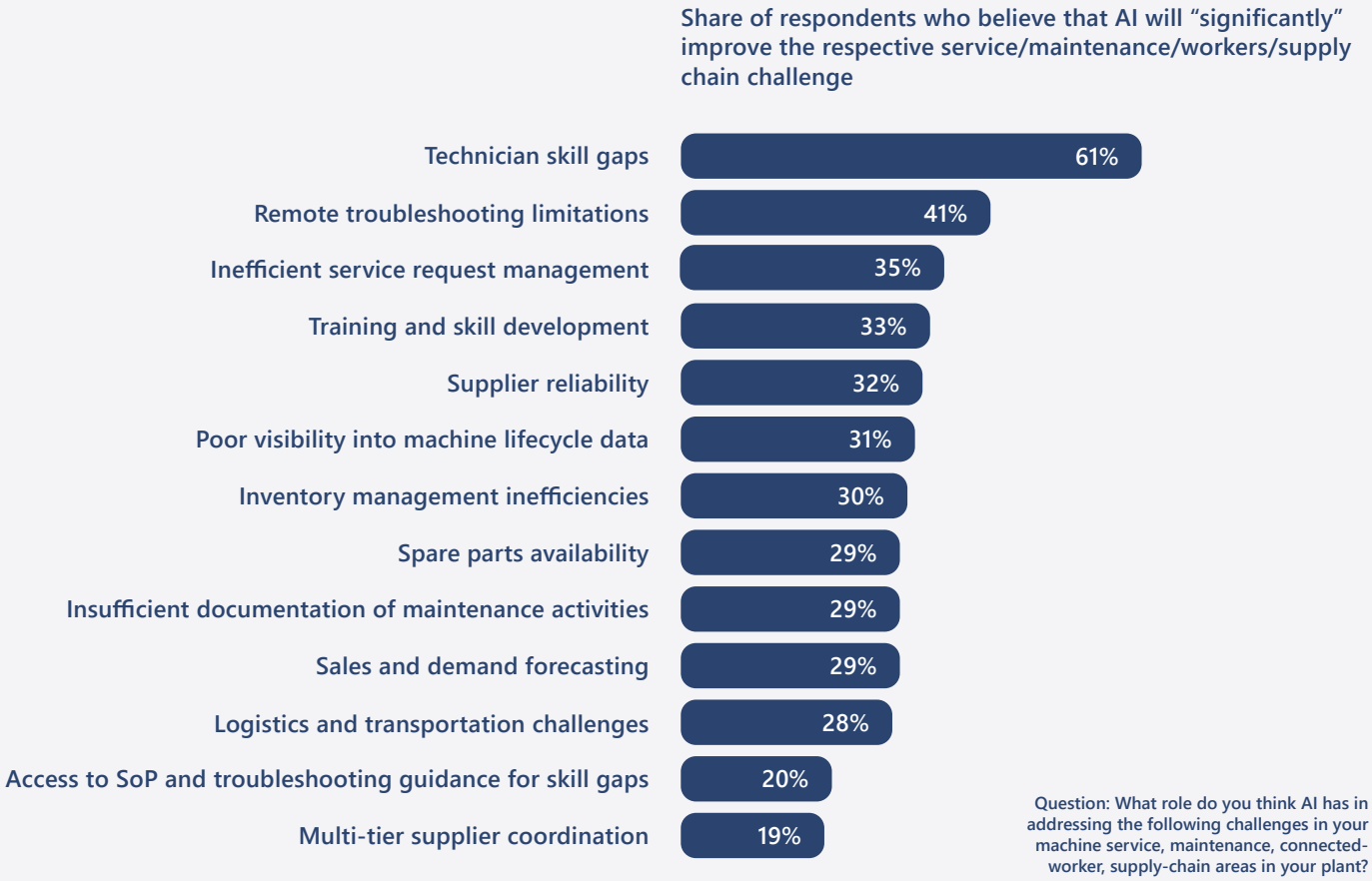
The role of AI in the service, maintenance, and supply chain of machines

Design | Build | **Operate**

Machine builders see AI as a key driver in improving service, maintenance, and supply chain operations. AI is expected to help close technician skill gaps (61%) and enable remote troubleshooting (41%). Top use cases include AI-powered service workflow automation (43% deployed), remote diagnostics (48% deployed), and demand forecasting (35% deployed).

Exhibit 14: Where AI is expected to deliver the most value in service, maintenance, and supply chain

Technician support, remote troubleshooting, and improving service request management are the top expected impact areas.



Where the machine building industry expects AI to deliver the most impact in service, maintenance, and supply chain

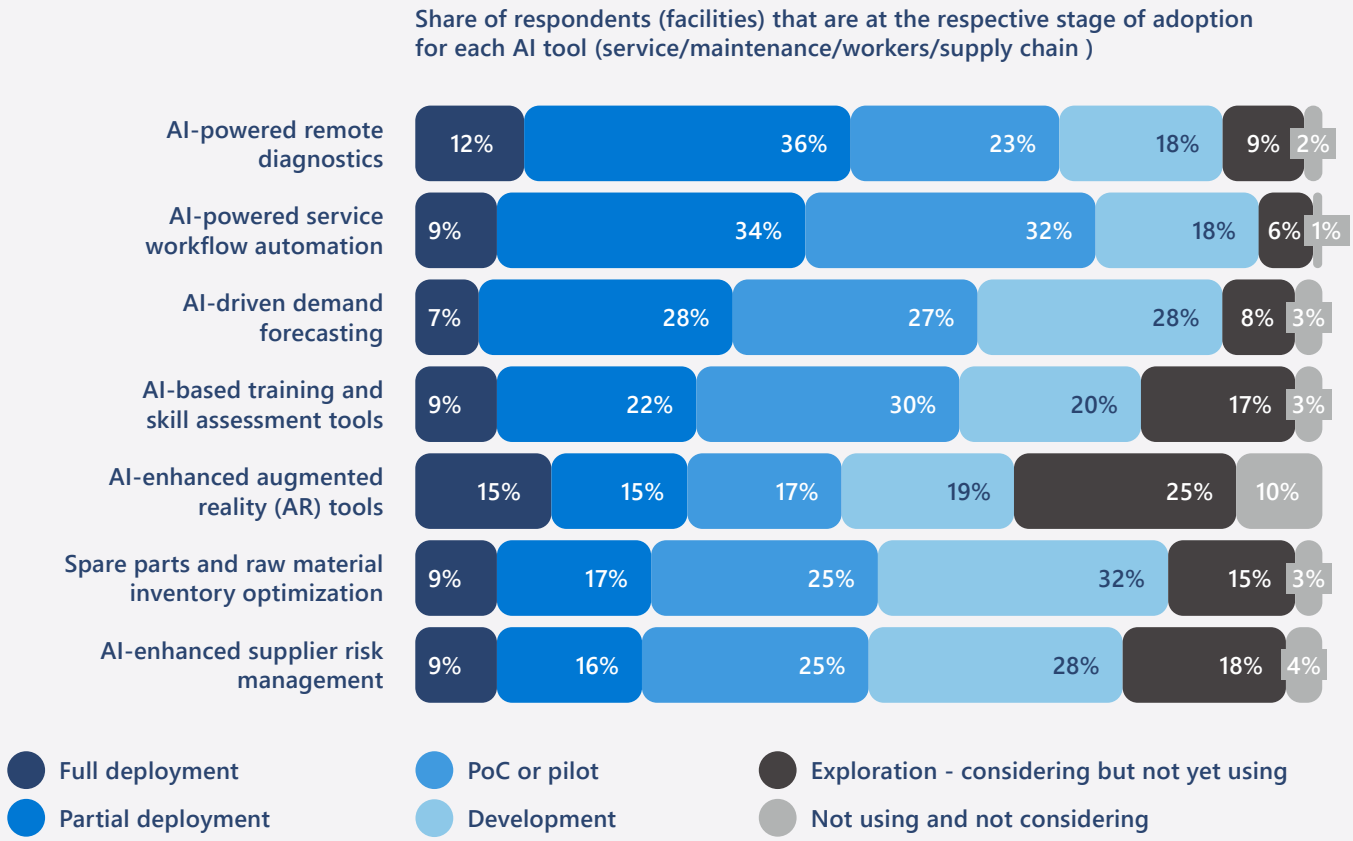
Addressing technician skill gaps. 61% of respondents believe AI will significantly help close technician skill gaps. AI-powered tools can provide guided diagnostics, contextual information, and on-the-job training—especially valuable as experienced field service workers retire.

Enabling remote troubleshooting. 41% of companies expect AI to improve remote troubleshooting significantly. This includes AI-assisted diagnostics, remote condition monitoring, and GenAI-based support tools that help reduce service visits and downtime.

Current adoption and trial activity in service and supply chain

Exhibit 15: Top AI use cases being trialed and deployed in service and supply chain

Service workflow automation and remote diagnostics are the most widely adopted use cases.



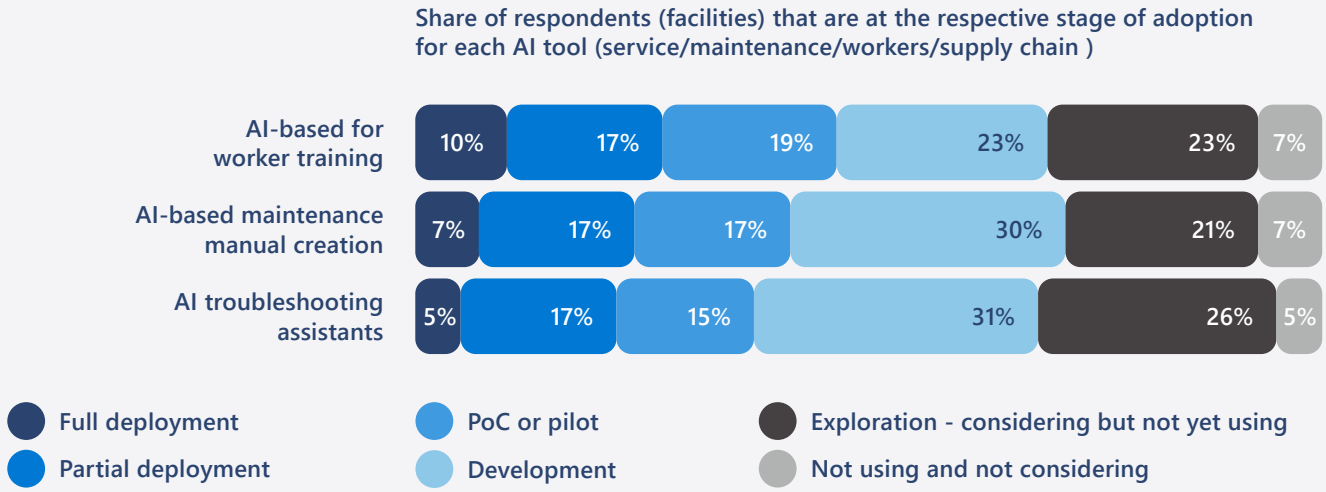
Question: What role do you think AI has in addressing the following challenges in your machine service, maintenance, connected-worker, supply-chain areas in your plant?

AI adoption in service, maintenance, and supply chain.

In post-production operations, AI is being applied to improve service responsiveness, predict maintenance needs, and optimize inventory planning. The top AI use cases include AI-powered service workflow automation (43% deployed/50% trialing), AI-powered remote diagnostics (48% deployed/41% trialing), and AI-driven demand forecasting (35% deployed/55% trialing). These tools help reduce service response times, minimize downtime, and optimize spare parts planning and inventory management.

Exhibit 16: Top GenAI use cases being trialed and deployed in services and supply chains

GenAI-powered worker training is being trialed to improve onboarding and skill development.



Question: What role do you think AI has in addressing the following challenges in your machine service, maintenance, connected-worker, supply-chain areas in your plant?

GenAI adoption in service, maintenance, and supply chain.

GenAI is starting to support technician training and workforce development, helping companies address skill gaps and improve service quality. One use case gaining traction is GenAI-based worker training (27% deployed/42% trialing). This use case leverages GenAI-powered virtual assistants and training modules to support technician onboarding, upskilling, and on-the-job learning.

"We see clear value in using GenAI to preserve the knowledge of experienced workers. As many senior employees retire, there's a real risk of losing decades of domain expertise. By building domain-specific language models, we can capture that know-how and use it to train new staff more effectively."

—Technical director at a leading energy equipment manufacturer in the U.S.

Case Study: AI adoption across design, build, operate

How a leading agricultural OEM is adopting AI

A leading agricultural OEM is embedding AI into core design and manufacturing processes to reduce costs, speed up innovation, and improve quality.

As a global player in the off-highway machinery sector, the company is adopting AI to address long-standing product development and operations inefficiencies. The company is prioritizing time-to-market, cost optimization, and continuous innovation. With a focus on vision systems, simulation tools, and real-time information access, it is already seeing measurable gains in critical areas.

What challenges were they facing?

- **High defect rates in assembly and field performance.** Similar-looking parts, such as bearings, were being misassembled, leading to quality defects during production and post-sale.
- **Slow, repetitive design cycles with cross-domain complexity.** With hydraulic, mechanical, and electronic teams involved, product designs required multiple iterations and physical testing, delaying launches.
- **Inventory overstocking led to high costs and space constraints.** Large amounts of inventory limited factory space for new product lines and drove up carrying costs.

> "Speed to market is the number one priority… we are constantly looking at how we can leverage AI to optimize internal costs and efficiencies."
>
> —Director, Digital Manufacturing Engineering at a leading agriculture machinery manufacturer

How is AI being applied?

AI in design:

- **AI-powered simulation to accelerate testing and validation.** AI models are used to simulate durability and reliability during early design phases, reducing reliance on slow and expensive physical tests.
- **GenAI for conceptual design and part configuration.** GenAI tools assist in generating early design concepts and evaluating material combinations, reducing manual engineering time.
- **Bill of materials (BOM) and cost forecasting.** AI helps estimate machine cost impacts based on different part combinations, supporting better BOM planning during the early design phase.

AI in manufacturing:

- **Vision-based quality inspection for critical assembly steps.** Fixed camera systems equipped with vision sensors check for correct part fitment, such as bearings. Trained image sets detect errors flagged through the MES to prevent defects from progressing.
- **Optimize production plans to reduce inventory and improve flow.** AI is used to identify optimal machine sequencing in production, helping minimize inventory levels and improve space utilization.

AI in service:

- **Service support via GenAI tools.** Service engineers retrieve machine-specific part and service data using GenAI-based assistants for faster response times.

> "We are constantly looking at how we can leverage AI to optimize internal costs and efficiencies—whether it's R&D, manufacturing, or sourcing costs."
>
> **—Director, Digital Manufacturing Engineering at a leading agriculture machinery manufacturer**

What barriers have they encountered in AI adoption?

- **Integration complexity across disjointed systems.** Vision systems needed to integrate with the MES platform, requiring collaboration with MES and sensor vendors. Lighting variations and surface finishes affected image quality.
- **Legacy systems lacked data accessibility.** Older conveyor belt systems and control panels did not support data extraction, necessitating hardware modernization like adding sensors and gateways.
- **Workforce upskilling and cultural resistance.** Operators were initially uncomfortable with camera-based monitoring. Extensive training and change management were needed to ensure adoption.
- **Infrastructure readiness and investment hurdles.** AI workloads require modern computing and storage platforms. Getting buy-in for those investments meant building strong business cases.

> "It's not just about the tech; workforce readiness is a huge challenge. Some employees were reluctant to embrace the change to camera-based inspection systems. It's a cultural shift as much as a technical one."
>
> —Director, Digital Manufacturing Engineering at a leading agriculture machinery manufacturer

What outcomes have they achieved so far?

- **20–30% defect reduction in early AI deployments.** Vision-based quality inspection and production plan optimization have led to 20–30% reductions in defects and improved operational control.
- **Faster design-to-build cycles.** Simulation and machine concept generation have helped cut engineering rework and speed up design phases.
- **Reduced inventory footprint and associated costs.** Optimizing inventory levels has freed up manufacturing space, helping to accommodate new product introductions.

> "We are already seeing that AI-driven solutions are cutting down design time significantly. For instance, we use simulation tools to speed up testing, so we no longer rely on all the traditional physical tests."
>
> —Director, Digital Manufacturing Engineering at a leading agriculture machinery manufacturer

What's next on the AI roadmap?

- **Expanding GenAI for repetitive, low-value tasks.** Areas like inventory data queries and part lookup are being explored for GenAI applications.
- **Targeting energy and safety optimization.** Exploring IoT and AI to reduce energy consumption (e.g., in HVAC and paint booths) and track safety compliance (e.g., PPE and ergonomics).
- **Phased scaling based on pilot outcomes.** AI adoption is progressing iteratively. The focus remains on refining early deployments and expanding to other operations with proven returns.

> "We're still in the iteration phase—but in the areas where it's implemented, the results are already visible. We'll scale from there."
>
> —Director, Digital Manufacturing Engineering at a leading agriculture machinery manufacturer

3 Getting started with AI

A four-step approach is helping machine builders adopt and scale AI

Machine builders recognize that successful AI adoption requires more than just new tools—it requires the right approach. Survey data shows that machine builders are focusing on four key areas: clearly defining business problems, improving data maturity, building cross-functional teams, and investing in workforce upskilling.

These steps are helping companies move from isolated pilots to more integrated and scalable AI initiatives. Whether in design, manufacturing, or service, this structured approach ensures that AI aligns with business goals, has the right data backbone, and is supported by empowered teams across the organization.

Microsoft

Framework for AI adoption

Clear problems, a strong data foundation, the right teams, and upskilling are the key pillars of the structured approach to adopting AI.

As machine builders explore AI's potential across design, manufacturing, and service, success will depend not only on technology but also on how organizations structure their approach to adoption and scale. The survey results reveal that machine builders are focusing on four core enablers to move from pilots to broader AI integration.

4 steps to getting started with AI

1 **Identify business need**
Focus on identifying the core business problem or challenge. Avoid starting with technology.

2 **Build cross-functional teams**
Encourage collaboration between AI experts, IT, and operational stakeholders to align AI efforts with real-world challenges.

3 **Improve data maturity**
Assess and strengthen how data is collected, stored, and shared. Build unified repositories and enhance data quality.

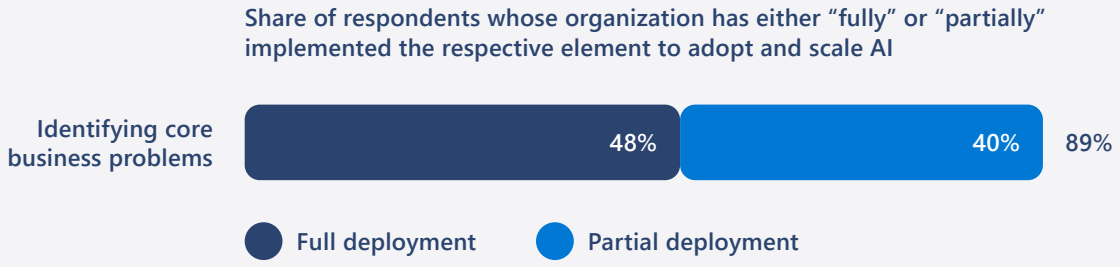
4 **Upskill the workforce**
Train teams to work effectively with AI by developing problem-solving capabilities and digital fluency.

Step 1: Identify core business problems

Rather than starting with technology selection, organizations begin by asking: **Where can AI deliver measurable improvement?** This often means targeting bottlenecks in design, reducing unplanned downtime, or improving service responsiveness. These use cases tend to offer clearer ROI and faster buy-in. Clearly defining the business challenge helps align teams, limit the scope of pilots, and set meaningful KPIs for evaluation. This step also improves coordination with technology vendors and solution integrators by sharpening the problem statement.

Exhibit 17: AI adoption step: Identifying core business problems

Most companies have already identified problems AI should solve



Question: To what extent has your organization implemented the following key elements in adopting and scaling AI?

"Start small and build. We didn't begin with AI, we started by identifying a clear problem—our production schedules were often delayed because different teams were making planning decisions manually using disconnected tools. Once we focused on that specific issue, we were able to build an AI solution that addressed it directly."

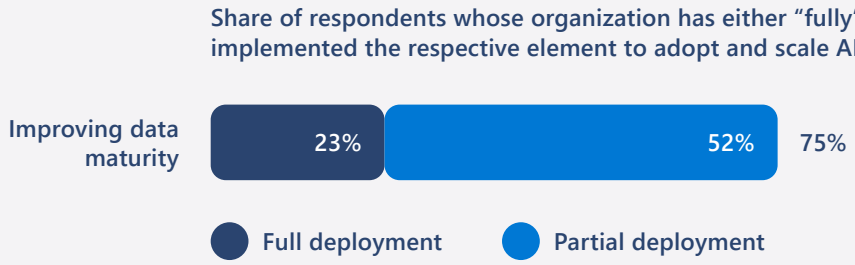
—VP Global Manufacturing Operations at a leading semiconductor equipment manufacturer

Step 2: Improve data maturity

AI use cases in design, manufacturing, and service all require reliable data inputs—from CAD libraries and sensor feeds to service logs and ERP records. Data silos, inconsistent formats, and lack of real-time availability are common roadblocks. Improving data maturity is not about building the perfect infrastructure upfront. Companies can start with specific data pipelines for priority use cases and expand over time. Targeted approaches can allow teams to show early results while strengthening the data foundation.

Exhibit 18: AI adoption step: Improving data maturity

Three out of four companies are actively working to strengthen their data foundations for AI.



Question: To what extent has your organization implemented the following key elements in adopting and scaling AI?

"Building a data strategy is crucial. We need to collect all types of data, whether structured or unstructured. Adding context to the data, such as the last maintenance date of equipment, is also important. Data cleaning is essential as well. Since we know our data best, we have developed our own algorithms to clean it."

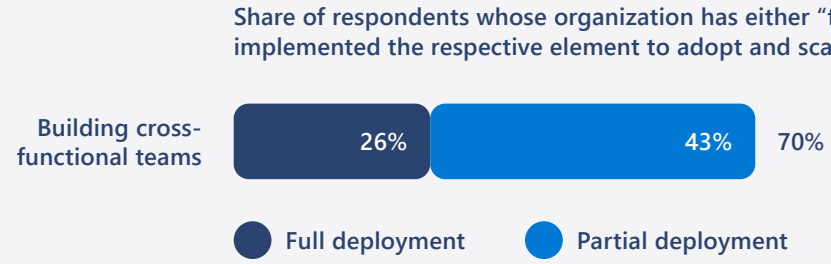
—Technical director at a leading energy equipment manufacturer in the U.S.

Step 3: Build cross-functional teams

To make AI work in real business settings, companies need teams that bring together technical and operational expertise. Engineers, production managers, and service experts understand how machines are built and used, while data and software specialists know how to develop AI tools. When these teams work together, they can build solutions that are both useful and realistic. For example, an engineer might explain how a part typically fails, and the AI team can then create a model to predict those failures in advance. This kind of teamwork helps AI projects move faster and makes the solution more likely to be used in daily operations.

Exhibit 19: AI adoption step: Building cross-functional teams

Most companies are bringing together domain and technical experts to drive AI initiatives



Question: To what extent has your organization implemented the following key elements in adopting and scaling AI?

"We started by building a focused team that deeply understood both our product domains: hydraulics/mechanical/electronics and AI. Once they could link real engineering challenges with potential AI solutions, we gradually expanded awareness across the rest of the organization."

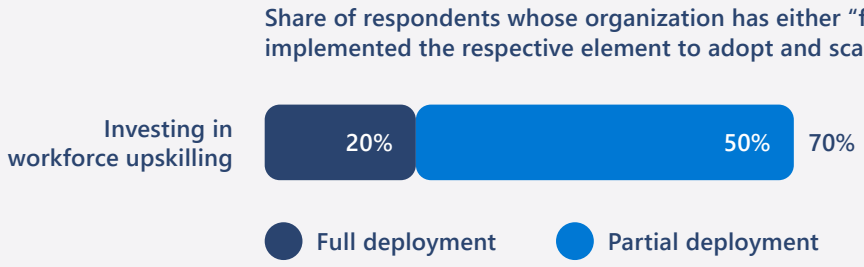
—Director, Digital Manufacturing Engineering at a leading agriculture machinery manufacturer

Step 4: Invest in workforce upskilling

Upskilling efforts include technical training, change management workshops, and the introduction of GenAI copilots that support real-time learning. These initiatives help reduce resistance, close skill gaps, and empower teams to experiment with new tools. In particular, service technicians and factory operators benefit from AI-assisted interfaces that guide them through troubleshooting, optimization, or configuration tasks. Over time, these tools not only improve efficiency but also serve as on-the-job training platforms.

Exhibit 20: AI adoption step: Upskilling the workforce

Many companies are training their teams to work effectively with AI



Question: To what extent has your organization implemented the following key elements in adopting and scaling AI?

"To adopt AI effectively, we needed to upskill our workforce first. Many of our operators and technicians didn't have prior experience working with AI tools, especially when dealing with machines that were specially customized."

—Director, Digital Manufacturing Engineering at a leading agriculture machinery manufacturer

How Microsoft can support your next actions

For manufacturing organizations worldwide, adopting artificial intelligence presents a significant opportunity and the impacts are transformational to help drive efficiency improvements, quality control, cost reductions, and business growth. Given the highly competitive and dynamic environment, now is the time for action. There are also many challenges due to the rapidly evolving nature of the technology and determining the optimal areas for its implementation to maximize business benefits and impact.

To learn more about how Microsoft can help your AI planning and strategies with a market-leading industrial AI technology platform and real solutions to build the plant of the future, review these resources:

Winning strategies for AI-driven innovation and operations

Unlocking the future of manufacturing with AI-powered digital threads

5 Leading AI use cases in manufacturing

IOT ANALYTICS

This report is based on research by IoT Analytics.

IoT Analytics, founded and operating out of Germany, is a leading global provider of market insights and strategic business intelligence for the IoT, AI, the cloud, edge technology, and Industry 4.0.

Visit our website
Contact us

Microsoft