Manufacturing Leadership Council

SURVEY REPORT

SHAPING THE AI-POWERED FACTORY OF THE FUTURE

FUTURE OF MANUFACTURING PROJECT

PROJECT SPONSORS

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INTRODUCTION

Now in its fourth year, the Manufacturing Leadership Council's "Future of Manufacturing Project" continues to focus on its main goal: to enable manufacturers to envision what manufacturing might look like in the future. Achieving this goal entails thinking broadly about the intersection of the technology, organization and leadership trends shaping Manufacturing 4.0, the stage of industrial progress based on digitalization. It also requires an intense focus on specific aspects of those trends to understand, at a deep level, the opportunities and challenges.

This research paper is part of the Project's focus this year on what MLC calls "AI-Centric Factories of the Future." It's a focus on how artificial intelligence will play an increasingly vital role in tomorrow's factories. Manufacturers will leverage AI across all aspects of the factory—from the shop floor to the boardroom, from suppliers to employees to customers, and from innovation to execution and decision-making.

The survey report follows an MLC event held in December 2024 with the same title. The one-day conference explored three key aspects of an AI-Centric Future: realization of value through AI-enabled innovation and decision-making; defining the human relationship around the relationship of AI to ecosystems, lean manufacturing and ethics; and reimagining factories across the spectrum from augmentation to full automation—all enabled by AI.

In the second half of 2025, the MLC will continue to focus on AI-centricity with webinars, case studies and additional research. **Please check the MLC website for updates and further information.**

The MLC team thanks its Future of Manufacturing Project partners—Accenture; Infor; Invisible AI; Kalypso, a Rockwell Automation Business; NTT DATA and West Monroe—for their support, their invaluable feedback on the survey report and their commitment to imagining a better future for manufacturing.

EXECUTIVE SUMMARY

The future of manufacturing is not waiting on AI; it is being built with it. The Future of Manufacturing Project survey reveals that while AI adoption in manufacturing is still in the early stages, it holds immense potential for transforming the industry. As manufacturers look ahead, AI is poised to play a pivotal role in shaping operations, with challenges and opportunities on the horizon. This survey underscores how companies are starting to integrate AI into their operations and highlights the urgency of aligning AI strategies with broader organizational goals.

For the manufacturers willing to commit, the payoff could be transformative. The data reveals a growing consensus: 68% of respondents say that AI will be foundational to future competitiveness.

Even among companies still early in their AI journey, there is little doubt about this technology's potential. In fact, every type of AI technology is expected to see increased adoption in the next two years—with edge AI, agentic AI and physical AI showing the greatest gains in terms of expected use.

Sixty-one percent of respondents expect their company's investment in AI to increase in the next two years.

As they ramp up investments, manufacturers will have to deal with many issues, including how they manage and govern the technology. Currently, 35% of manufacturers have a formalized AI governance strategy at the enterprise level, and another 35% are in the process of developing one. This signals strong momentum in AI adoption. AI's presence is still limited in operations, however. Only a reported 18% of manufacturers use a formal AI strategy in their operations, and another reported 43% of manufacturers say that a formal AI strategy for operations is in development. There is work ahead to scale these technologies across the factory floor.

Despite this promising outlook, manufacturers face ongoing barriers to using and scaling AI. Data quality and accessibility remain the top challenges, with 65% of manufacturers reporting they lack the right data for AI applications and 62% citing data that is unstructured or poorly formatted. Overcoming these issues will be critical to enabling broader AI adoption and realizing its full potential.

The imperative for AI is clear, but so are the hurdles. Manufacturers must invest in data infrastructure, talent and scalable systems to ensure they do not fall behind in this rapidly changing landscape.

The path forward isn't plug-and-play. In addition to the speed bumps already cited, skill gaps, cultural friction and legacy systems are hurdles to adoption and usage.

What will separate the leaders from the laggards is the ability to build momentum. It is less "go big or go home" and more "crawl, walk, run." The future belongs to manufacturers that can fail fast, scale what works and adapt without stalling.

Other key takeaways from the survey:

- Leadership involvement in AI is still developing, with nearly one-third of respondents unaware of who is leading AI governance within their organizations.
- Manufacturers are more likely to partner with outside organizations to implement AI. In fact, only 25% say they are building their own AI solutions.
- Sixty-three percent of those with defined targets for AI's value are achieving or exceeding their targets.

SECTION 1

AI GOVERNANCE AND STRATEGY

When the current age of industrial AI was at its beginning, early manufacturing use cases included predictive equipment maintenance, optimized quality inspections and more accurate demand forecasting. As these types of use cases move toward the mainstream, a new breed of AI-based technology is keeping things fresh and relevant—but as enigmatic as ever.

Generative AI is serving as a catalyst for increased interest from industrial organizations, but adoption is restrained. While many manufacturers are seeking the best place to start operational deployment, others are getting the underpinnings in place for broader AI adoption. These preparations include strategic roadmaps for AI usage, integrating AI strategy with a broader data strategy and establishing a governance structure for AI deployment. For those coming on board with GenAI, use cases include such things as virtual assistants that can guide work processes or advise on decision-making, systems that can make suggestions for how to adapt or adjust operations, customer service automation, and document search and synthesis.

In the not-so-distant future, developing a robust AI strategy may become as fundamental to business success as having a sound financial plan or a comprehensive marketing approach. As mentioned in the Executive Summary, 35% of respondents said that their organization has an enterprise-wide AI governance strategy, and the number is growing—another 35% say that such a plan is in progress.

Accounting only for manufacturing operations, though, just 18% have an AI strategy in place. However, 43% say that a plan is in the works, indicating strong momentum and likely investment for deploying AI in more factories. It is common for manufacturers—particularly large organizations—to have company-wide technology policies in place. As technologies mature and nuances become apparent, these organizational policies may require addendums for individual functions. It appears this is what is happening with AI policies for manufacturing operations. In any case, more than one-third of manufacturers (37%) say they lack any sort of formalized plan or guidance for AI utilization (Chart 1).

ENTERPRISE-WIDE GUIDELINES OUTPACE FORMAL AI GUIDELINES FOR MANUFACTURING OPERATIONS

Does your company have a corporate-wide governance plan, strategy, roadmap or formal guidelines for how AI is utilized across the enterprise? Do you have a specific plan for manufacturing operations? (Select one.)

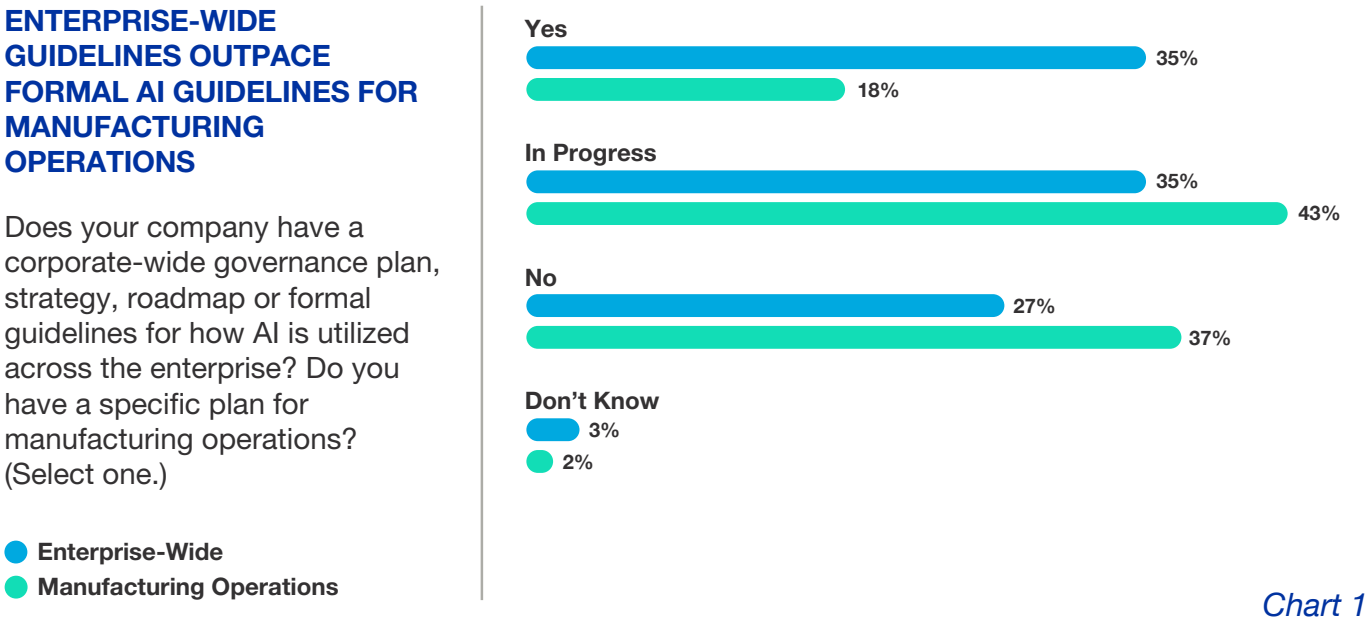


Chart 1

As companies seek to reap the most value from their troves of business data, a large and growing number of them have developed formalized data strategies. Because an AI deployment is only as good as the data at its foundation, many manufacturers find it sensible to align their corporate AI and data strategies. Achieving this is still a work in progress—21% say that they have a formally integrated AI and data strategy at the enterprise level, while only 13% can say the same for manufacturing operations.

Others have less formalized, looser connections between those strategies (26% of manufacturing operations), while a slightly smaller group (19%) says that their AI and data strategies are independent for manufacturing operations. Still, for both the enterprise level (26%) and for manufacturing operations specifically (36%), the most common response to the existence of a formal AI and/or data strategy is that there is none (Chart 2).

AI AND DATA STRATEGY INTEGRATION STILL A WORK IN PROGRESS

How connected is your AI strategy as part of your data strategy? (Select one.)

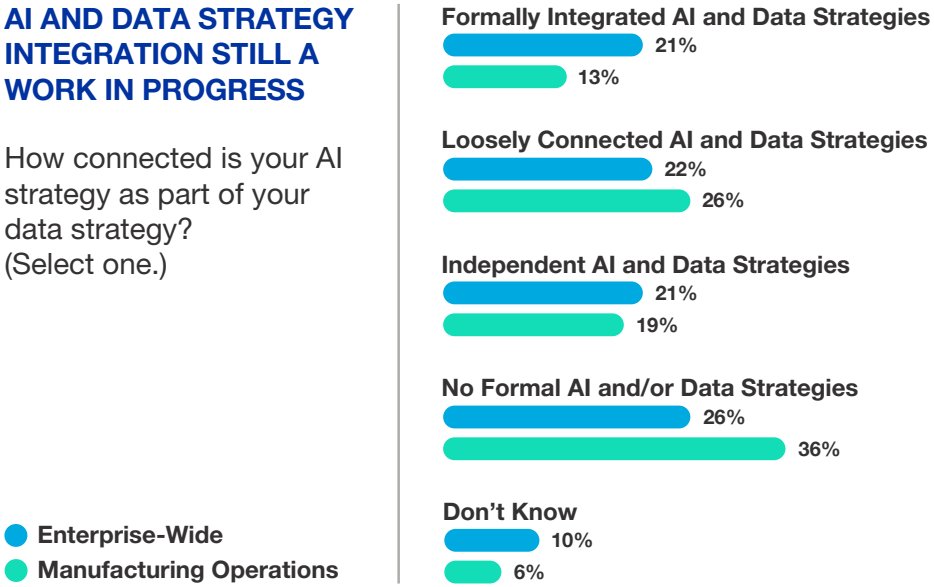


Chart 2

Just like any technology initiative, AI success means a company needs to have someone who keeps the use of that technology moving forward while overseeing its strategic growth. For manufacturers, primary responsibility for AI governance and strategy most frequently lies with the vice president/director of IT (21%). It is also often under the authority of someone in the C-suite, with chief digital/data officers, chief information officers and chief information security officers among those leading the charge at other organizations.

However, nearly one-third of respondents could not tell who oversees AI governance at their organization, either because nobody has that responsibility (13%), or they do not know who is in charge (18%) (Chart 3). For companies to lead on AI, there must be a clearly appointed member of the team to oversee AI.

C-SUITE RESPONSIBLE FOR AI GOVERNANCE IN ONE-THIRD OF MANUFACTURERS

Who is primarily responsible for AI governance and strategy in your organization? (Select one.)

- Vice President/Director of IT: 21%
- Joint OT/IT Team: 14%
- Chief Digital/Data Officer: 12%
- Chief Information Officer: 9%
- Chief Executive Officer: 5%
- Chief Information Security Officer: 4%
- Chief Operating Officer: 2%
- Chief Financial Officer: 1%
- Legal/Compliance Team: 1%
- No One Has AI Governance Responsibility: 13%
- Don't Know: 18%

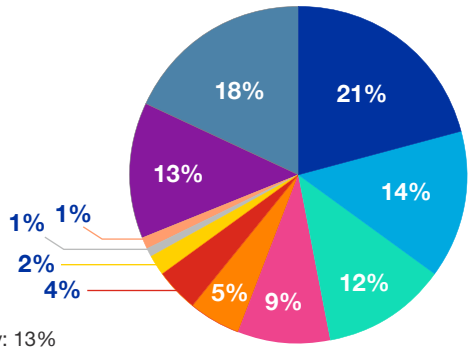


Chart 3

SECTION 2

APPLICATION OF AI

AI is a comprehensive suite of applications, from traditional AI such as machine learning to advanced AI such as agentic AI. While GenAI and other advanced AI technologies are getting a lot of press, it is the traditional, well-proven machine learning and vision systems applications that dominate usage today. Current usage shows that more than 70% of respondents are leveraging vision systems and machine learning. Vision systems are often used in quality control at the process and/or product level. Machine learning, which is more often used around innovation and continuous improvement, is being leveraged by roughly 45% of respondents. GenAI, while still new, is also being implemented by about 45%. Meanwhile, large and small language models (LLMs and SLMs) sit at 27% usage today, while no other technologies are above 20% as they are still in the pilot or exploratory stages or, perhaps, not even on the radar for some manufacturers.

Looking ahead two years, vision systems usage remains high with more than 70% expecting to continue their use of this technology. Machine learning, including applications to support predictive learning, will jump from 46% to more than 70% as the current use cases mature and scale. GenAI shows a small increase in expected use as it remains third. As GenAI use cases solidify and outcomes prove beneficial, we expect to see its use increase. LLMs and SLMs linked to GenAI also show an increase to 37%. Edge AI shows the biggest increase after machine learning in expected use as it moves from 20% to 45%. This will, undoubtedly, be tied to manufacturers still in the transition period of developing and implementing their overall edge strategy. All other AI technologies are expected to remain in the pilot or exploratory stages, though it is worth noting that both agentic AI and physical AI show significant growth potential for the next two years. As clearly demonstrated use cases are shown, we expect these usage numbers to increase (Chart 4).

TRADITIONAL AI SOLUTIONS WILL CONTINUE TO DOMINATE INTO THE FUTURE

What types of AI solutions are you using today? In two years? (Select all that apply.)

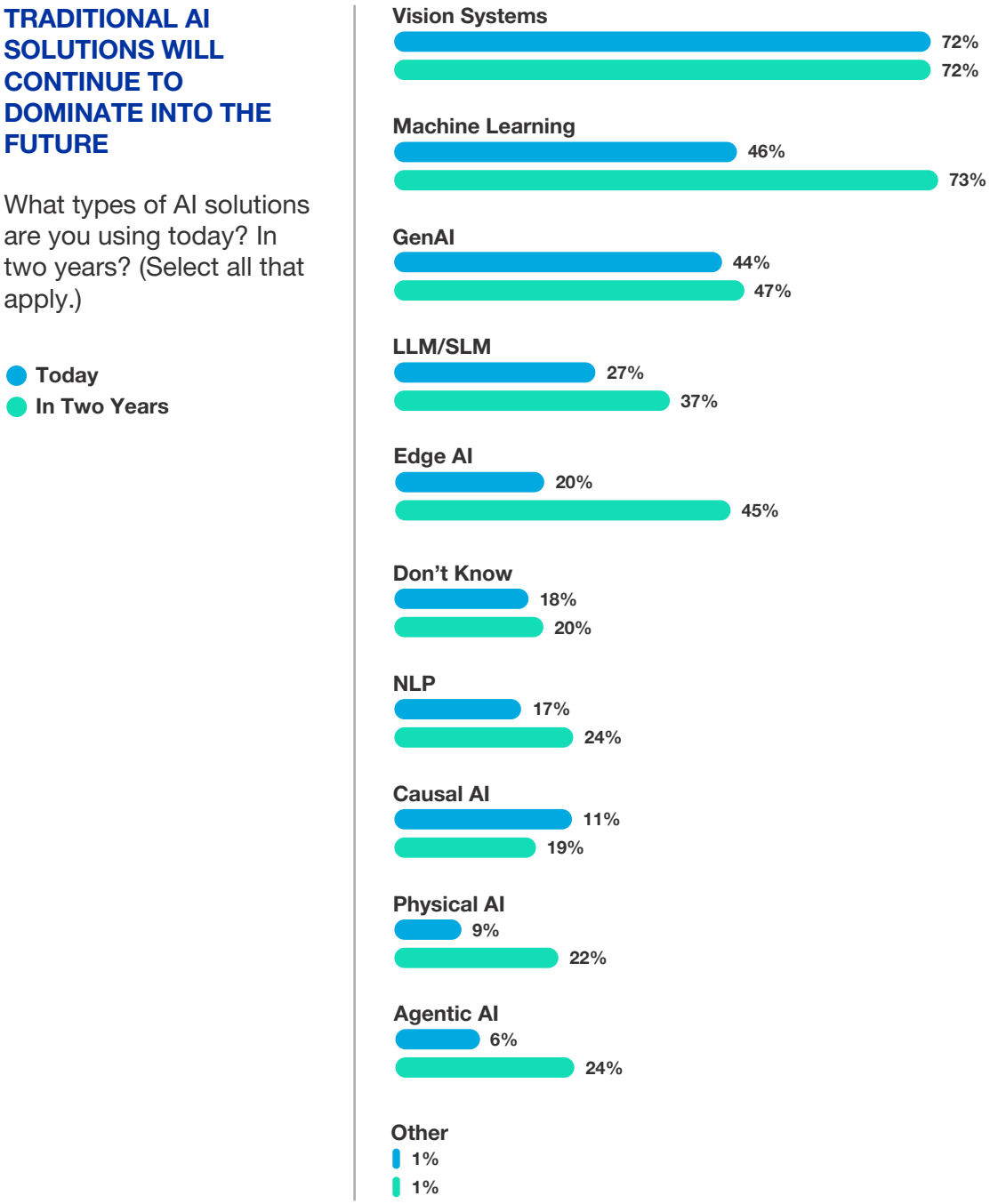


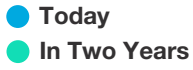
Chart 4

When we look deeper into AI use across various manufacturing process areas, we see these broad numbers confirmed. Vision systems and machine learning are used widely in both process and discrete manufacturing. Beyond that, we see "no current use case" as the dominant response across every AI technology except vision systems, signaling growth potential for every AI application.

Moving two years out, we see much the same trends with vision systems and machine learning being the dominant use cases for process and discrete manufacturing and increased usage in engineering and maintenance. GenAI shows an overall increase in expected use in all areas, although "no anticipated use" is still the most common answer. Meanwhile, most other AI technologies are expected to see moderate increases in use across the manufacturing areas (Chart 5).

VISION SYSTEMS AND MACHINE LEARNING HAVE MOST WIDE USE TODAY. GROWTH EXPECTED FOR ALL AI TECHNOLOGIES.

Where are you currently using AI in operations today, and where do you expect to use it during the next two years?



MACHINE LEARNING

	Today	In Two Years
Process Manufacturing	36%	64%
Discrete Manufacturing	26%	45%
Engineering	16%	33%
Maintenance	18%	35%
Facilities	6%	16%
Product Development	7%	17%
Supplier Management	3%	12%
Logistics	4%	18%
No Anticipated Use	43%	18%

NATURAL LANGUAGE PROCESSING

	Today	In Two Years
Process Manufacturing	8%	21%
Discrete Manufacturing	8%	15%
Engineering	13%	21%
Maintenance	2%	14%
Facilities	2%	7%
Product Development	5%	14%
Supplier Management	2%	9%
Logistics	3%	14%
No Anticipated Use	76%	57%

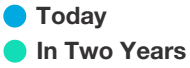
VISION SYSTEMS

	Today	In Two Years
Process Manufacturing	43%	59%
Discrete Manufacturing	40%	47%
Engineering	14%	27%
Maintenance	11%	25%
Facilities	7%	11%
Product Development	1%	10%
Supplier Management	0%	3%
Logistics	5%	9%
No Anticipated Use	25%	18%

Chart 5, Part 1

VISION SYSTEMS AND MACHINE LEARNING HAVE MOST WIDE USE TODAY. GROWTH EXPECTED FOR ALL AI TECHNOLOGIES.

Where are you currently using AI in operations today, and where do you expect to use it during the next two years?



GEN AI

	Today	In Two Years
Process Manufacturing	15%	33%
Discrete Manufacturing	16%	23%
Engineering	17%	31%
Maintenance	13%	27%
Facilities	3%	12%
Product Development	14%	24%
Supplier Management	4%	17%
Logistics	6%	14%
No Anticipated Use	52%	47%

AGENTIC AI

	Today	In Two Years
Process Manufacturing	6%	19%
Discrete Manufacturing	3%	14%
Engineering	7%	17%
Maintenance	3%	14%
Facilities	1%	5%
Product Development	2%	14%
Supplier Management	1%	9%
Logistics	5%	11%
No Anticipated Use	85%	67%

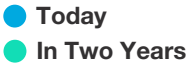
PHYSICAL AI

	Today	In Two Years
Process Manufacturing	3%	23%
Discrete Manufacturing	5%	15%
Engineering	5%	15%
Maintenance	5%	10%
Facilities	2%	8%
Product Development	2%	8%
Supplier Management	0%	5%
Logistics	3%	9%
No Anticipated Use	86%	66%

Chart 5, Part 2

VISION SYSTEMS AND MACHINE LEARNING HAVE MOST WIDE USE TODAY. GROWTH EXPECTED FOR ALL AI TECHNOLOGIES.

Where are you currently using AI in operations today, and where do you expect to use it during the next two years?



CAUSAL AI

	Today	In Two Years
Process Manufacturing	7%	18%
Discrete Manufacturing	6%	15%
Engineering	6%	17%
Maintenance	1%	19%
Facilities	2%	9%
Product Development	2%	9%
Supplier Management	0%	8%
Logistics	1%	8%
No Anticipated Use	85%	67%

LARGE/SMALL LANGUAGE MODELS

	Today	In Two Years
Process Manufacturing	10%	23%
Discrete Manufacturing	10%	23%
Engineering	15%	24%
Maintenance	9%	20%
Facilities	1%	9%
Product Development	7%	18%
Supplier Management	2%	13%
Logistics	4%	14%
No Anticipated Use	67%	58%

EDGE AI

	Today	In Two Years
Process Manufacturing	14%	34%
Discrete Manufacturing	14%	36%
Engineering	6%	16%
Maintenance	3%	16%
Facilities	2%	6%
Product Development	3%	10%
Supplier Management	0%	3%
Logistics	1%	6%
No Anticipated Use	74%	47%

Chart 5, Part 3

SECTION 3

AI INVESTMENT AND VALUE

As data and AI foundational capabilities are being developed, AI investments in operations trail capital equipment budgets. Almost 60% of respondents have stated that AI investments from operations are less than 10% as compared with their capital equipment budget, with another 30% not knowing what, if any, AI investments are coming from operations (Chart 6).

CAPITAL EQUIPMENT BUDGETS FAR OUTPACE AI INVESTMENTS

What is the level of AI investment in operations as compared to your capital equipment budget? (Select one.)

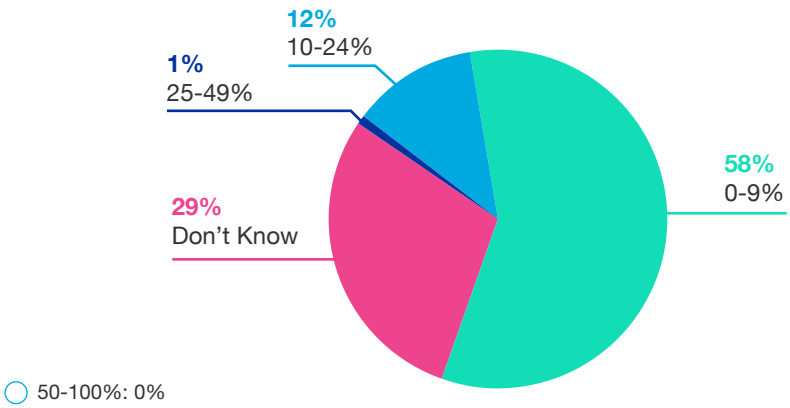


Chart 6

Looking toward the future, there is an expectation that there will be some increase in operations-specific AI funding. While 61% expect at least some investment increase, one-third of all respondents anticipate that increase to be less than 50%, while just under 20% predict no increase at all (Chart 7).

This is a number worth monitoring in the future. It will be interesting to see if the level of AI investments grows proportionally as skills, ROI and trust increase (shown in Chart 16).

AI INVESTMENTS ON HORIZON, BUT MANY EXPECT MODERATE INCREASE

How do you expect the AI investment in operations to change over the next two years? (Select one.)

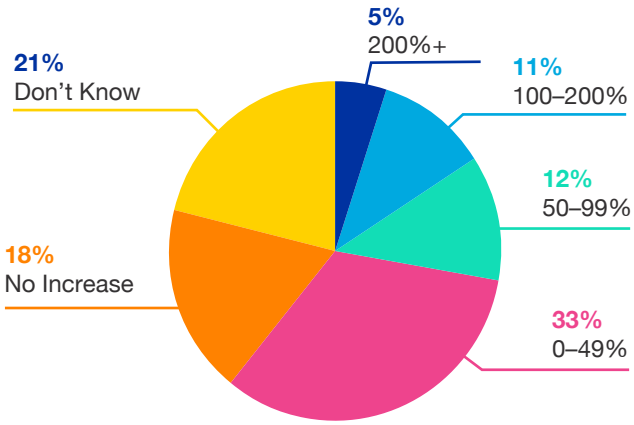


Chart 7

When it comes to AI implementation, we see a mix of build, buy and partner to develop AI solutions with partnering being the majority approach. This model of partnering is similar to what has been seen with other M4.0 technologies. Additional data about company size would validate the general trend of larger, more digitally mature manufacturers tending to build their own solutions, while small, less digitally mature manufacturers prefer to buy. Partnering, however, has proven to be a successful approach for companies of all sizes and maturities with respect to other M4.0 technologies, so it is no surprise to see more than 40% of respondents taking that approach (Chart 8).

PARTNERING IS AI IMPLEMENTATION METHOD OF CHOICE

How are you implementing AI? (Select top answer.)

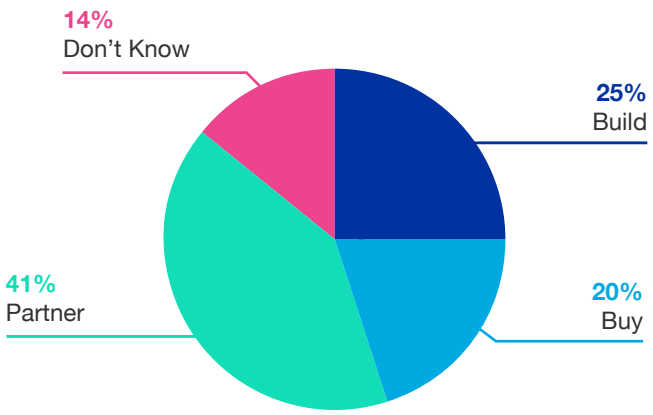


Chart 8

Within companies, the people responsible for implementing AI aligns with data shown earlier about the lack of enterprise-wide AI and data strategy structure. More than half of respondents see individual contributors and/or technology providers implementing AI in their organization. A smaller number (45%) see AI implementation being led by the company overall. Interestingly, a much smaller number (22%) see consultants leading AI implementation (Chart 9).

INDIVIDUALS AND TECH PROVIDERS LEAD MAJORITY OF AI IMPLEMENTATIONS

Who is implementing AI? (Select all that apply.)

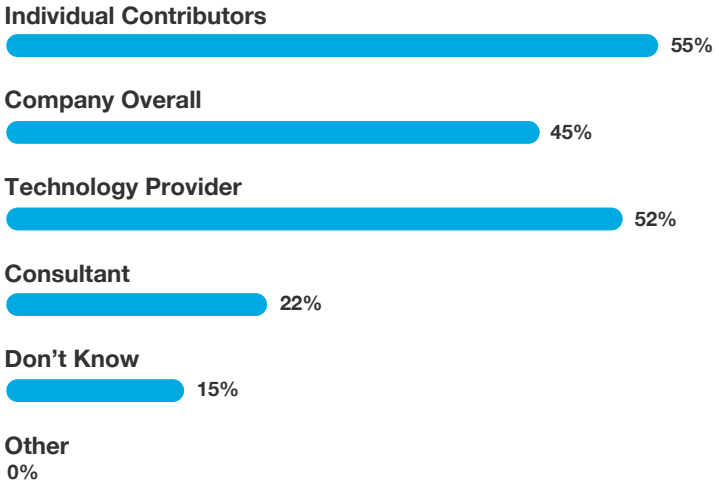


Chart 9

The top three measures of AI value align with traditional operational-efficiency metrics. Impact on operational performance, cost savings and worker productivity/efficiency are all above 60% with no other metric above 22%. This data highlights a pragmatic and performance-oriented mindset among manufacturers when it comes to assessing the value of AI.

However, the data also reveals that one in four manufacturers are not yet measuring the value of AI at all. This lack of measurement could hinder strategic clarity and make it harder to scale successful initiatives.

Meanwhile, manufacturers are still in the early stages of maturity when it comes to recognizing AI's broader impact beyond cost and productivity. Very few respondents assess value through customer metrics (0% use NPS), qualitative employee satisfaction (10%) or AI-driven revenue streams (5%).

As the industry matures, developing more holistic value measurement frameworks could be critical to capture AI's full strategic potential (Chart 10).

VAST MAJORITY MEASURE AI'S IMPACT THROUGH TANGIBLE OUTCOMES

How do you measure the value of AI in your organization? (Select top three.)

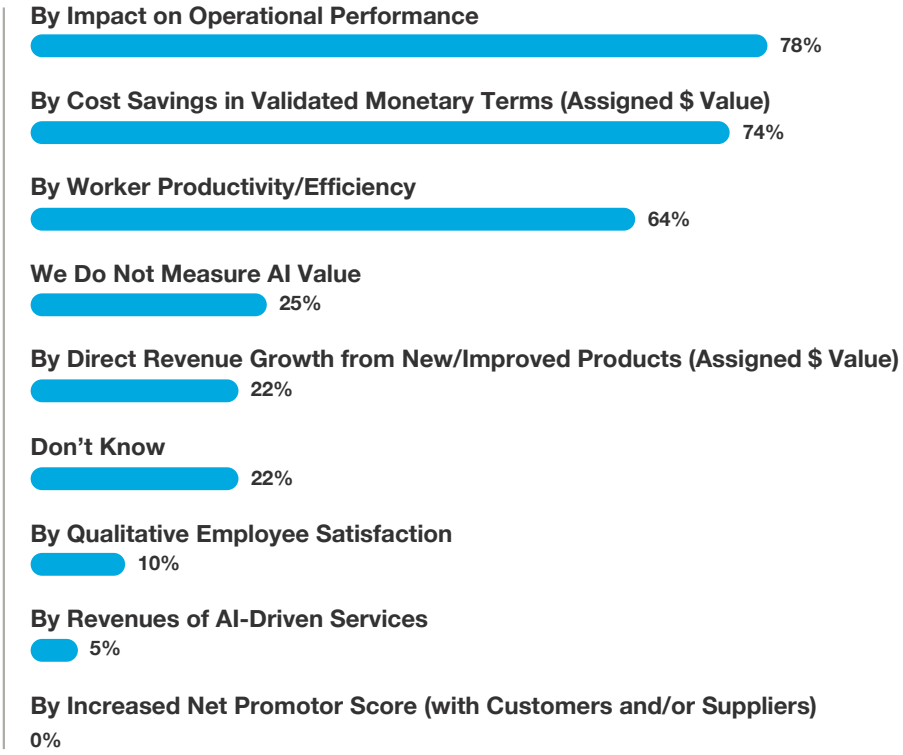


Chart 10

Moreover, while many companies are measuring the impact of AI, almost 60% do not have a target defined for that impact. Defining the targets is an important first step that organizations should take. Our data reveals that the majority of those with targets are meeting or exceeding those targets. In fact, for those organizations that have defined targets, 43% are hitting their targets with another 20% overachieving. Still, 37% of organizations that have defined targets are underachieving those targets (Chart 11).

MAJORITY WITH DEFINED AI TARGETS ARE MEETING OR EXCEEDING

How is the value of AI in your organization doing vs. targets? (Select one.)

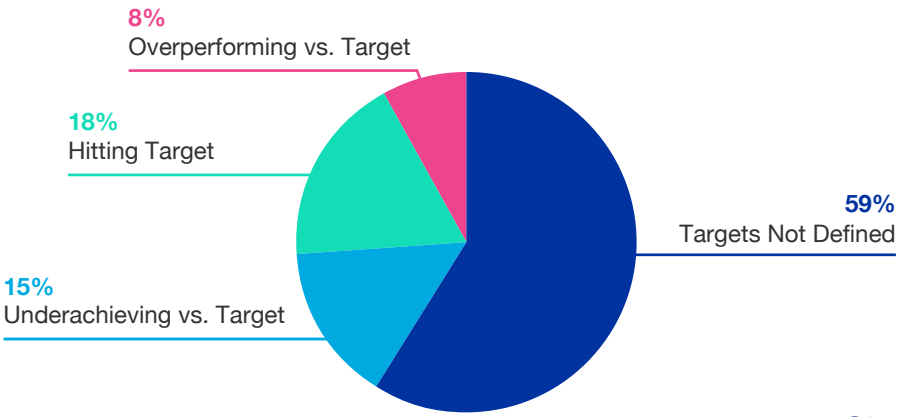


Chart 11

Looking at value in a different way, we asked respondents what the primary objectives for leveraging AI are today and what they expect them to be in two years. Continual improvement was the primary objective today (50%). The next four objectives for today—predict, automate, optimize and knowledge acceleration—were cited by 30% to 34% of respondents.

Looking ahead, continual improvement is projected to have a significant decline as a primary objective—indicating a shift toward higher value use cases. In fact, automation and predict are both expected to increase 8 percentage points as primary objectives. After that in the results, analyze to understand operations is also expected to rise in the next two years. Coupled together these three gains show that manufacturers are beginning to see AI not just as a reactive or descriptive tool, but also as a resource to anticipate problems and optimize performance proactively.

Meanwhile, 38% of respondents—the same percent as predict—expect continual improvement to still be a primary objective in two years. Holding steady, optimize and knowledge acceleration are expected to maintain their status as a primary objective for the same percentage—34% and 32%, respectively—both today and in two years (Chart 12).

SHIFT IN AI PRIMARY OBJECTIVES SEEN ON HORIZON

What are your primary objectives for leveraging AI today? In two years? (Select top three.)

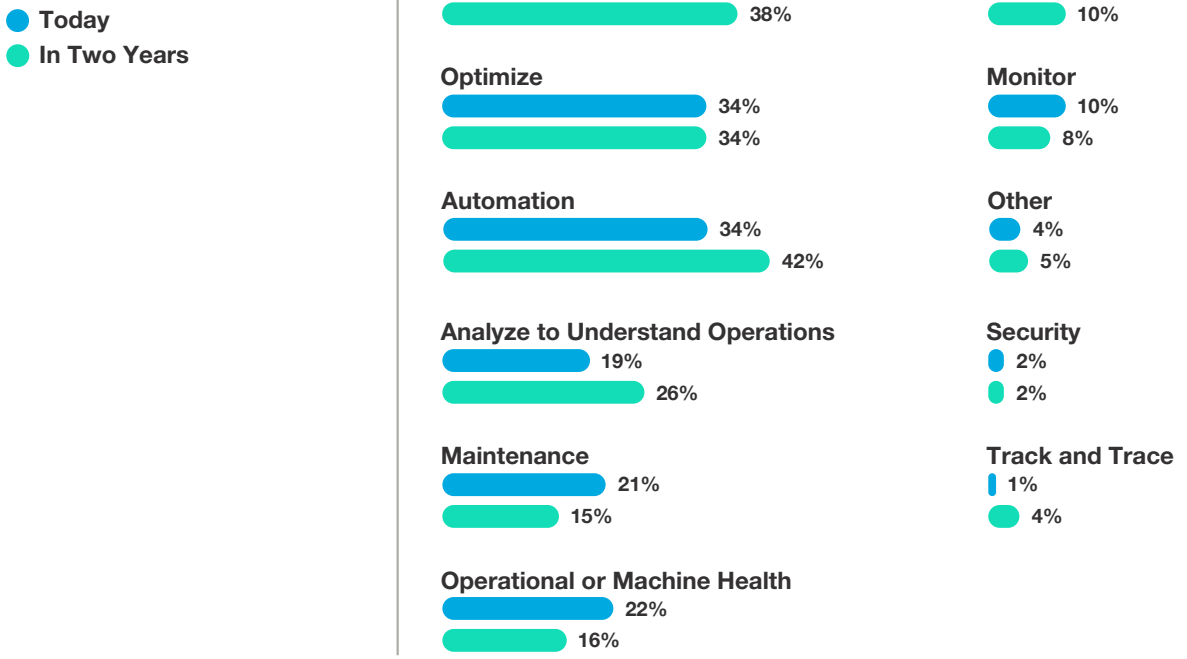


Chart 12

SECTION 4

AI KNOWLEDGE AND ENGAGEMENT

Leaders need not only champion AI but also model its use. This has been an important topic during the past two Future of Manufacturing Project events. Leaders must support AI and personally learn and engage with it.

Our data shows that while some companies and leaders are making progress, there is still quite a bit of work to be done. When it comes to AI education, many leaders at the C-suite (44%), senior plant level (47%) and department/functional level (44%) are aware of AI concepts. For supervisors and team leaders on the factory floor, however, the majority (53%) have no education on AI concepts. Finally, no more than 6% of leaders use AI on a regular basis or have integrated it fully into their daily work (Chart 13).

WHILE AI AWARENESS IS PROMISING, USE LAGS

How educated is your senior leadership around AI? (Select one per job function.)

- Fully Integrated AI into Their Daily Work
- Using AI on a Regular Basis
- Using AI on Occasional Basis
- Educated on AI
- Aware of Concepts
- None

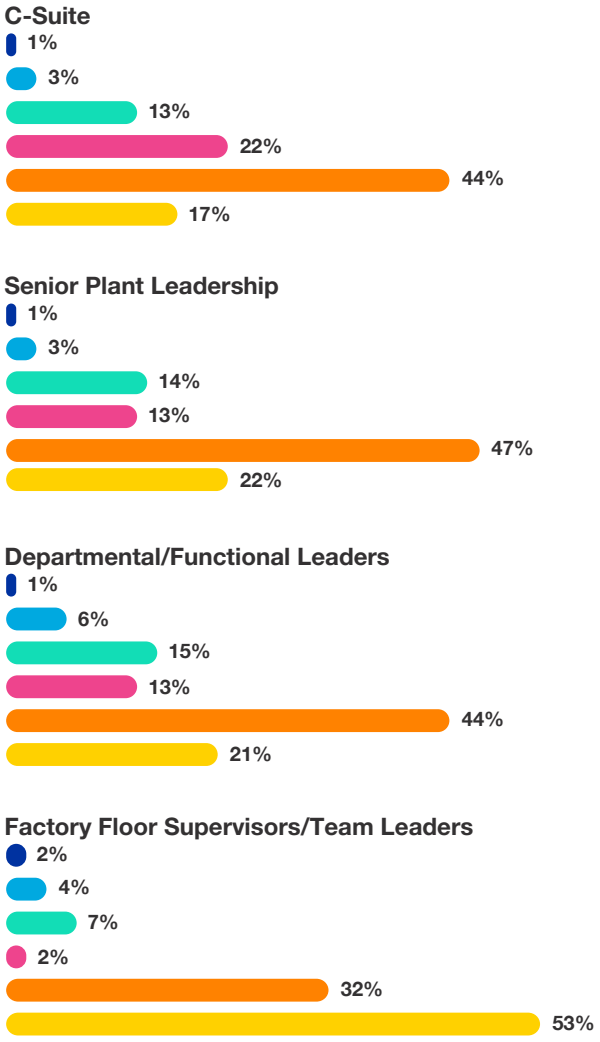


Chart 13

We see slightly different trends when it comes to engagement. The good news is that at least 30% of leaders in any functional area or level of the organization are aware of AI and talk about it. In fact, at the higher levels (C-suite, senior plant leadership and departmental/functional leaders), a promising number of organizations also see leadership support via funding and directed use of AI.

Yet the biggest concern is that slightly more than half of factory floor leaders have no engagement with AI. This group also ranks last in terms of involvement with AI and personal use of AI in their work. While upper-level leaders can show awareness and support funding, frontline workers must see their immediate supervisors and team leaders model and support its use (Chart 14).

FACTORY FLOOR LEADERS' AI ENGAGEMENT ALARMINGLY LOW

How educated is your senior leadership around AI? (Select one per job function.)

- Personally (Uses AI in Their Own Work)
- Supportive (Provides Funding for AI)
- Aware (Talks About AI)
- Involved (Directs Use of AI for the Organization)
- None

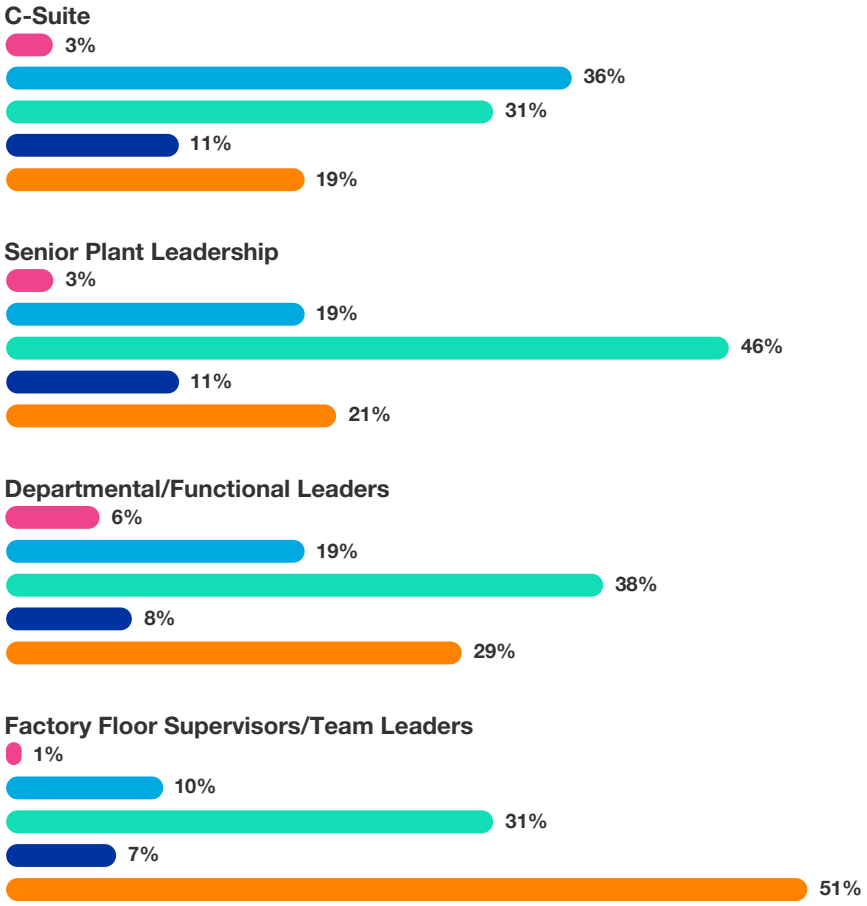


Chart 14

SECTION 5

CHALLENGES AND FUTURE TRENDS

As manufacturers race toward an AI-centric future, adoption stands as both an opportunity and an ongoing challenge. While the technology's potential is well understood—from predictive maintenance to autonomous decision-making—many organizations are still struggling to operationalize AI at scale. The challenges span three major categories: data, people and enterprise systems.

Manufacturers are encountering serious friction when it comes to building the data foundations necessary for AI. Sixty-five percent of survey respondents say they lack the right or useful data for AI applications, and 62% cite data that is not formatted or structured for AI use. Poor data quality (49%), lack of AI models to leverage data (45%), data inaccessibility (43%) and data that is not trustworthy (37%) round out the top concerns.

Collectively, these issues represent a foundational bottleneck that could cascade through every stage of AI adoption, from training models to deploying them in real-world production environments. AI systems are only as effective as the data they are built on, and without necessary, well-structured, clean and accessible datasets, AI models will fall short—especially as we think beyond current AI technologies.

These numbers point to a broader maturity gap in manufacturers' digital infrastructure. Despite years of investment in M4.0 technologies, much of the data collected remains isolated in silos or trapped in legacy systems. As manufacturers set their sights on AI to drive predictive autonomous decision-making and more advanced future applications, these data limitations will continue to slow progress—unless organizations invest in robust data governance, interoperability strategies and cross-functional data collaboration. In a landscape where competitiveness increasingly hinges on real-time intelligence, resolving these data challenges is a frontline business priority (Chart 15).

NEARLY TWO-THIRDS LACK USEFUL DATA

What are the most important data challenges or obstacles hindering your organization from leveraging AI more broadly? (Select top three.)

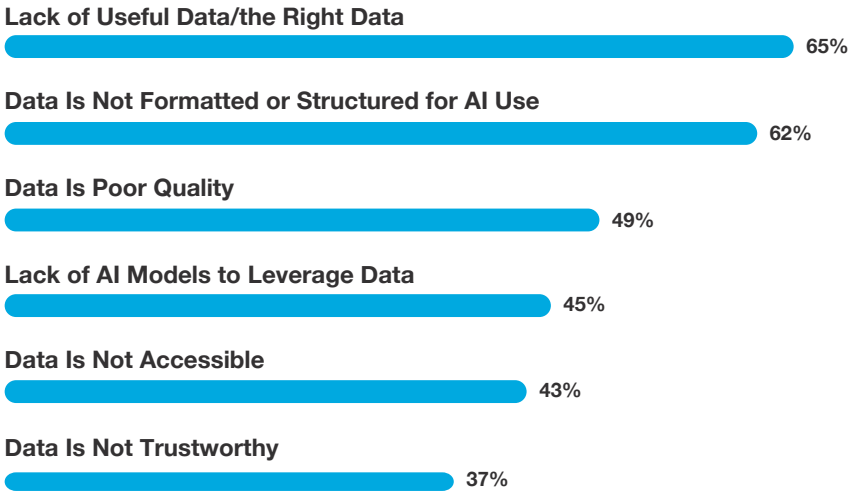


Chart 15

Even with solid data infrastructures, manufacturers cannot unlock AI's full potential without the right human capabilities—and here, the gap is even starker. Eighty-two percent of respondents say their organization lacks the skills to leverage AI effectively. However, it is not just a technical deficit. Seventy-one percent of respondents cite a lack of proof that AI drives better decisions (as demonstrated by ROI or use cases). Meanwhile, 65% point to a broader management challenge: leaders' inability or unwillingness to integrate AI into their decision-making. These hurdles speak to a deeper cultural and strategic hesitation.

Interestingly, concerns about job displacement showed up in only 22% of the responses. In the MLC's AI in Manufacturing Survey, published in the August 2024 *Manufacturing Leadership Journal*, 36% of respondents indicated that AI would lead to a headcount reduction. The declining concern about job displacement may indicate a recognition that AI may help companies "fill" the more than 400,000 open manufacturing jobs in the U.S., rather than displace currently employed workers (Chart 16).

LACK OF SKILLS, ROI EVIDENCE AND TRUST HOLDING AI BACK

What are the most important people challenges or obstacles hindering your organization from leveraging AI more broadly? (Select top three.)

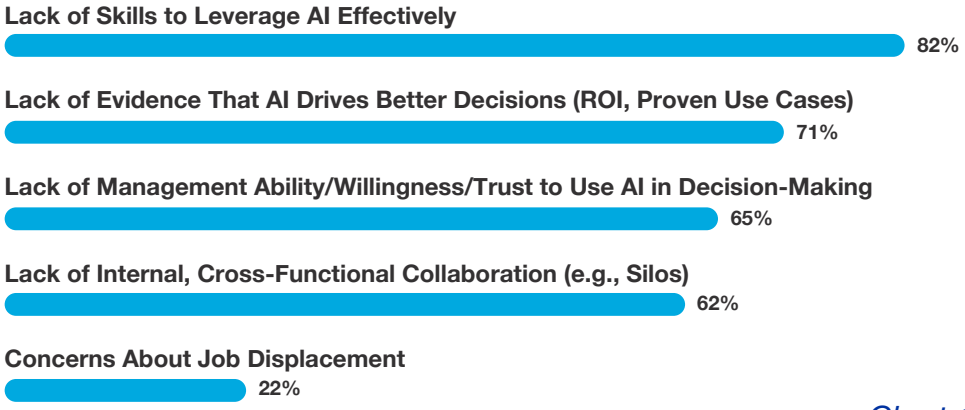


Chart 16

Enterprise-level barriers remain just as formidable. Seventy-eight percent of manufacturers struggle with legacy systems, poor connectivity and integration issues—making it difficult to link AI models into end-to-end operations. Similarly, 66% report difficulty scaling AI pilots into full production. These are not new problems, but they are increasingly urgent.

As manufacturers push to transition from isolated use cases to enterprise-wide AI applications, these systemic challenges, like the data bottleneck described previously, will become defining constraints over the next five years. Legacy infrastructure not only limits the ability to collect and act on data in real time, but also hinders the agility needed to adapt to rapidly evolving technologies and customer demands. Without modern, interoperable systems, manufacturers may find themselves locked into small-scale AI projects that never reach their full potential.

Cybersecurity risk (60%)—the third biggest enterprise challenge identified on the survey—adds further complexity to these issues. As AI becomes more deeply embedded in connected production environments, cybersecurity concerns will likely grow. Because manufacturing is a top cyberattack target, the need for secure systems, processes and procedures is becoming nonnegotiable.

Meanwhile, 57% of respondents also noted that the high cost of starting AI projects is an enterprise challenge for their organization. More than 98% of manufacturers are considered small businesses, so it is not surprising that cost is an important consideration. Given the legacy systems in place even at medium and large manufacturers, however, cost considerations go much deeper. To overcome these barriers, industry leaders will need to rethink capital investment strategies and embrace incremental modernization approaches—all while ramping up cybersecurity in parallel with innovation. In this context, the next five years will likely separate manufacturers that can scale AI from those that stall in pilot purgatory (Chart 17).

SIGNIFICANT ENTERPRISE BARRIERS REMAIN

What are the most important enterprise challenges or obstacles hindering your organization from leveraging AI more broadly? (Select top three.)

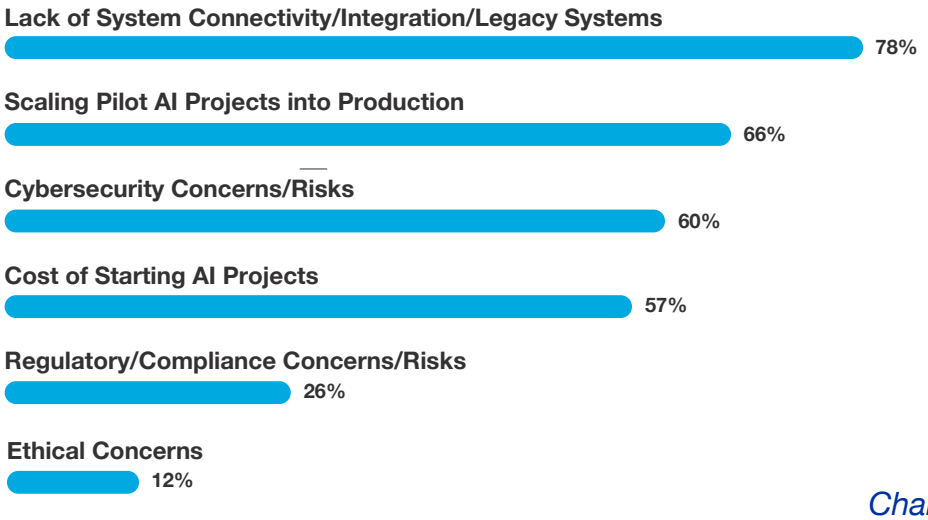


Chart 17

The interplay between data, people and systems creates a tightly wound web of challenges. You cannot deploy AI without clean, structured data. You cannot trust AI without the people and leadership in place to use it responsibly and productively. And you cannot scale AI without systems that are secure, connected and flexible enough to support it.

Manufacturers that are serious about becoming AI-centric must tackle all three dimensions at once. That means modernizing data architectures, investing in workforce development, building organizational trust and accelerating legacy infrastructure upgrades. Only then can the full power of AI be unleashed in manufacturing.

If there were any doubt about the strategic weight manufacturers place on AI, the answer becomes clear when looking toward the horizon. When asked how AI will affect their competitiveness by 2030, a full 68% of respondents said it will be essential to growing their business. That is not just a vote of confidence; it is a wake-up call and a mandate for action.

In an industry where capital investments are cautious and incremental, such a strong signal of urgency suggests that AI is no longer considered an optional experiment, but a core driver of future success.

Only 13% believe AI will be disruptive to their current business, hinting at a segment of the market that anticipates foundational shifts, which could manifest in fundamental changes in processes, products or workforce models. Meanwhile, just 11% view AI as merely supportive of business continuity, and an even smaller 3% say it will have no impact at all. These low numbers reflect a maturing understanding of AI's potential. The question is no longer if AI will reshape manufacturing, but how fast companies can adapt to capture the advantage (Chart 18).

In short, the competitive gap of the next decade may well be defined by how effectively manufacturers overcome today's barriers to unlock tomorrow's AI-fueled growth.

NEARLY 70% SEE AI AS ESSENTIAL TO GROW THEIR BUSINESS

Looking forward to 2030, how do you think AI in manufacturing will affect competitiveness as a future business? (Select one.)

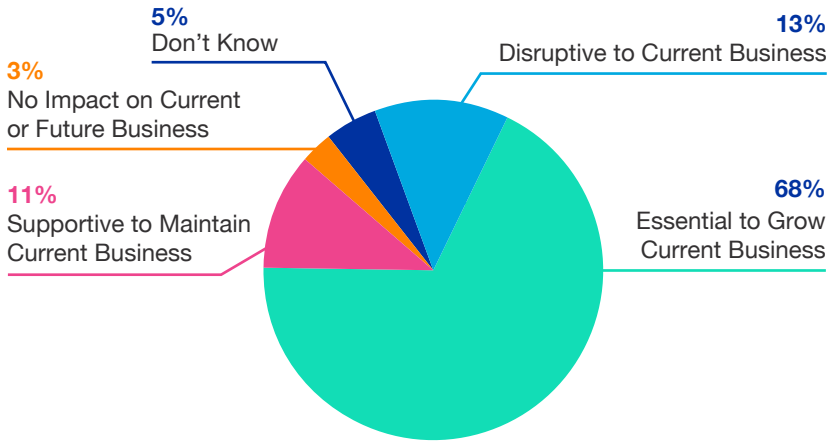


Chart 18

FINAL THOUGHTS

Today's story about AI in manufacturing has a familiar narrative. Whenever a new technology enters the market or when an existing technology, such as AI, enters a new phase and momentum for it builds rapidly, a gap occurs between aspirations and execution.

In the 1990s, comprehensive ERP systems offered great promise in bringing order to many functions, but they required significant process changes and more time to implement and optimize than anticipated. The same pattern attended supply chain management systems, product lifecycle systems, and other systems designed to automate functional areas.

Now, it is AI's turn. Even though AI systems have been around for many years and used in a variety of applications, their adoption had been constrained by the state of computer systems, communications bandwidth and sufficient volumes of data.

Most of these infrastructure issues have now been successfully addressed, setting the stage for a new era of analysis and insight that has the potential to not only identify and solve operational problems faster and more efficiently but also to open new ideas for products and services and even new business models for manufacturers.

The inflection point for AI—the event which has turbocharged interest in the technology and which has spurred massive levels of investment in its development—was the introduction of the generative AI tool ChatGPT in 2023. ChatGPT has been a catalyst for other forms of AI such as agentic AI, natural language AI and edge AI.

But like technological developments before it, the adoption and successful use of AI in manufacturing will face many of the same challenges experienced with other technologies. In fact, with AI, the gap between vision and aspirations and an organization's ability to fully leverage the technology may be substantially wider.

That's because AI is what MLC calls a pervasive technology, meaning that it will be incorporated into all sorts of systems spanning the factory floor to the front office and beyond to customers, suppliers and partners.

The fundamental challenge for manufacturers—the test of how long it will take to get to full value with AI and what hurdles must be cleared to get there—is not with the technology itself in the main (siloed data and legacy system adaptation are indeed issues). It is, rather, with how well a manufacturer can organize around the AI opportunity.

The organizational challenge has many dimensions, including AI strategy and investment levels even as the technology continues to rapidly develop; what governance rules to put in place; how best to bring people along to minimize cultural resistance; establishing clear lines of responsibility over who or what department should lead AI efforts; and deciding how value from AI should be measured.

This new MLC survey shines a light on these challenges and makes clear that building AI momentum and success will depend on successfully addressing them.

The key to it all, not surprisingly, is leadership. Leadership must become well versed about the technology, understand its potential and application, develop a vision and strategy for it, and drive change in a way that unites and motivates everyone in the organization.

The age of AI is now front and center. It is the next big step on the road to a better future for manufacturing.

GLOSSARY

Agentic AI: AI systems capable of autonomous decision-making and action-taking to accomplish goals, often integrating planning, reasoning and adaptability to dynamic environments.

Causal AI: AI that goes beyond correlation-based learning to understand cause-and-effect relationships, improving decision-making, diagnostics and scientific discoveries.

Edge AI: AI that runs on local devices rather than centralized cloud servers, enabling real-time processing and low-latency applications in areas like IoT, industrial automation and smart devices.

Generative AI: AI models that create new content, such as text, images, audio or code, based on training data. Examples include ChatGPT for text and DALL·E for images.

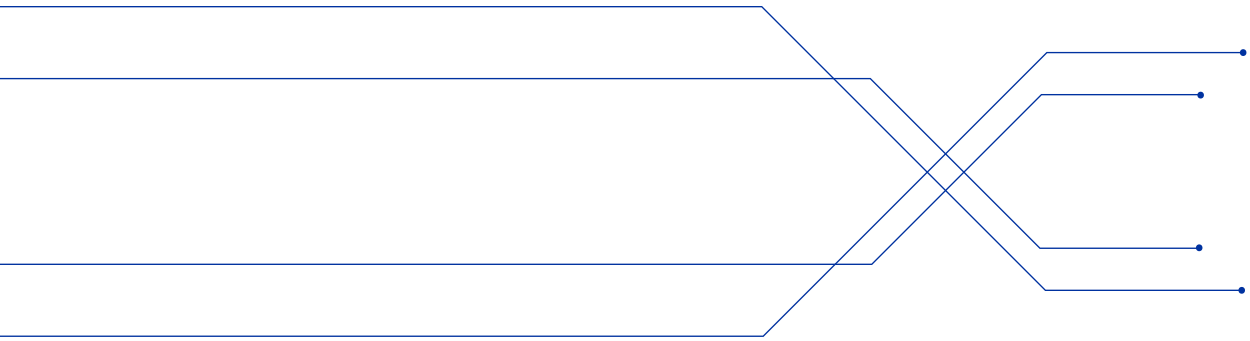
Large Language Models/Small Language Models: LLMs are advanced AI models trained on vast amounts of text to generate human-like language, while SLMs are smaller, more efficient models optimized for specific tasks with lower computational requirements.

Machine Learning: A subset of AI that enables systems to learn from data, identify patterns and make decisions with minimal human intervention. It includes supervised, unsupervised and reinforcement learning techniques.

Natural Language Processing: AI focused on enabling computers to understand, interpret and generate human language, allowing for applications like chatbots, translation services and sentiment analysis.

Physical AI: AI integrated into physical systems, such as robots or autonomous vehicles, enabling interaction with the physical world through sensors, actuators and adaptive control.

Vision Systems: AI that processes and interprets visual data from the world, such as images or videos, enabling tasks like facial recognition, object detection and quality control in manufacturing.



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As industrial companies seek to transform with emerging technologies and AI, Rockwell Automation and Kalypso are helping them create the future of industrial operations.

Rockwell Automation, Inc. (NYSE: ROK), the world's largest company dedicated to industrial automation and digital transformation, combines advanced hardware, software and services to drive productivity, resilience and sustainability across industries.

Kalypso, Rockwell's digital services business, helps companies unlock the power of digital solutions. From advancing automation to autonomy and creating a digital thread through the product lifecycle, Kalypso focuses on improving what's made and how it's made.

Together, Rockwell and Kalypso combine industry-leading automation with digital transformation expertise to solve complex production challenges, optimize processes and achieve measurable results—creating more resilient, agile and sustainable operations.

West Monroe is a digital services firm that was born in technology but built for business—partnering with companies in transformative industries to deliver quantifiable financial value. We believe that digital is a mindset—not a project, a team, or a destination—and it's something companies become, not something they do. That's why we work in diverse, multidisciplinary teams that blend management consulting, digital design, and product engineering to move companies from traditional ways of working to digital operating models—and create experiences that transcend the digital and physical worlds. Connected by the 13 founding values that drive our culture, our 2,200 employees work collaboratively across the firm with the belief that our clients' success is our success. Visit WestMonroe.com to learn more.

Manufacturing Leadership Council

Founded in 2008 and now a division of the National Association of Manufacturers, the Manufacturing Leadership Council's mission is to help manufacturing companies transition to the digital model of manufacturing by focusing on the technological, organizational and leadership dimensions of change. With more than 2,500 senior-level members from many of the world's leading manufacturing companies, the MLC focuses on the intersection of advanced digital technologies and the business, identifying growth and improvement opportunities in the operation, organization and leadership of manufacturing enterprises as they pursue their journeys to Manufacturing 4.0.

For more information, please visit
www. manufacturingleadershipcouncil.com.

NATIONAL ASSOCIATION OF Manufacturers

The National Association of Manufacturers is the largest manufacturing association in the United States, representing small and large manufacturers in every industrial sector and in all 50 states. Manufacturing employs more than 12.7 million men and women, contributes $2.71 trillion to the U.S. economy annually and accounts for 58% of private-sector research and development. The NAM is the powerful voice of the manufacturing community and the leading advocate for a policy agenda that helps manufacturers compete in the global economy and create jobs across the United States. For more information about the NAM or to follow us on Twitter and Facebook, please visit www.nam.org.

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Methodology

The survey was fielded in late February of this year and was concluded in March. Respondents included MLC operational executive members and qualified manufacturers.

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FUTURE OF MANUFACTURING PROJECT

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