



SURVEY REPORT

THE FUTURE OF INDUSTRIAL AI IN MANUFACTURING

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INTRODUCTION

The growing role and importance of artificial intelligence in manufacturing cannot be overestimated. This pervasive technology, now coming into its own after many years of development and trial and error, is being incorporated into many technologies involved in the manufacturing process, including semiconductors, software applications and platforms, and communications equipment. It will increasingly power the operation of ERP, PLM, MES, CRM and other key operational software applications. Robotic systems, too, will be guided more and more by AI.

Moreover, AI will be used to process and analyze growing volumes of operational data to enable companies to run equipment, predict the state of equipment and make better decisions based on insights derived from actionable data.

It is important for the manufacturing industry to understand how AI may shape how factories and plants are run in the years ahead, how it will influence workforce strategies, what business benefits may attend the use of AI and what challenges must be faced and overcome to realize the potential of this technology.

At the highest level, a global competition for AI dominance is underway, with manufacturing as a key player in the race. The industry's competitiveness at home and abroad will be defined increasingly by AI expertise, application and experience—but only in a trusted and responsible way.

For these reasons and more, the Manufacturing Leadership Council, under the auspices of its Future of Manufacturing Project, has focused its efforts this year on exploring AI's opportunities and challenges in manufacturing. Earlier this year, the MLC fielded a survey on AI to its members and others in the manufacturing community to assess their perceptions, plans, expected benefits and challenges in using AI in manufacturing. This report highlights the findings of that effort.

The MLC team wishes to thank its Future of Manufacturing Project partners—EY, Infor, NTT DATA and West Monroe—for their support and invaluable suggestions. In addition, the MLC thanks the members of its Board of Governors for their expert feedback in preparing this survey. **M.**



EXECUTIVE SUMMARY

Over the past two decades, many digital technologies have made a fundamental difference to the way manufacturers now operate and manage their businesses. Factories are almost unrecognizable compared to the way they were some 10 years ago. Yet, few of those technologies have held such pervasive promise as AI and machine learning in their potential to transform the future of the industry as it approaches 2030.

The Manufacturing Leadership Council's new Industrial AI in 2030 survey results reveal that while many manufacturers may only just be starting to leverage the possibilities of AI, they also have clear plans to accelerate that adoption significantly in the years ahead, with AI investment levels expected to rise in a substantial 96% of all the companies responding to the survey.

Right now a majority of manufacturing companies, 57%, are still piloting and experimenting with AI technology to identify how best it can be applied and managed, and to better understand what the implications may be for their operational strategies, their workforces and their future business models.

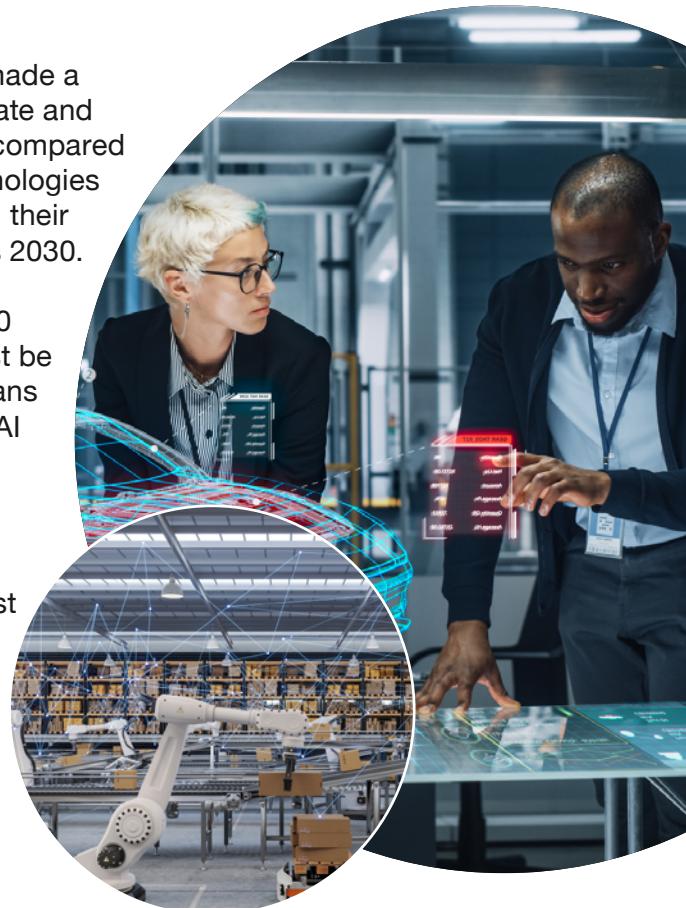
Those companies also report that many of their current AI projects are still being devised at a business unit or divisional level, and only around 29% of companies have so far elevated their AI initiatives into formal corporate AI plans or strategies.

Nevertheless, 28% of respondents say they are already implementing AI projects operationally, especially in the areas of manufacturing and production and inventory management, where more than one-third of companies in each category are focusing much of their AI activities. In manufacturing, for example, the top use cases right now are aimed at plant floor Internet of Things data analysis and preventative maintenance, although almost one-quarter are also applying AI to deliver improvements in supply chain and quality management, among many other functional areas.

Their primary expectation behind these advanced efforts is to harness AI's analytical power to reap a multitude of enterprise-wide benefits, from better decision making and cost savings to better planning and increased agility, competitiveness and sustainability.

Inevitably, however, many challenges along manufacturing's AI journey remain, from concerns about a lack of internal expertise to successfully manage and support AI deployments; to operational difficulties in accessing, managing and integrating the underlying data that AI systems need to be effective; and to ethical concerns about ensuring future AI systems are developed and used in safe and trustworthy ways.

And while some observers have also voiced fears that the widespread adoption of AI will take away human roles in manufacturing, almost one-third of respondents (32%) expect exactly the opposite. At least at this point in time, they believe they will need to hire more people in an AI-enabled world, even if the roles they perform may be different as AI systems automate routine tasks and allow workers to be retrained and reassigned to more value-added and engaging roles.



Even if some or many manufacturing operations do eventually become increasingly autonomous, 60% of respondents still predict that people will continue to play a key role in those manufacturing activities in the years to come.

The development of industrial AI, it seems, will indeed be fast and furious over the next few years and permeate almost every part of industrial enterprises. But it will also be a lot less about simply replacing people with clever machines, and much more about augmenting human intelligence and innovation to allow both manufacturing workers and leaders alike to make better decisions, to increase productivity and competitiveness and to develop more effective, agile, sustainable and rewarding business models by the end of the decade. .



SECTION 1

Status of AI Adoption

As is usually the case with a new technology, manufacturers are taking a methodical approach to using AI in their companies and production operations. This approach begins with creating awareness about the technology's possibilities and then conducting research into what application areas the technology is best suited to and which can provide tangible value.

Although AI as a concept and as a technology in various commercial product iterations have been around for many years, recent advances in supporting infrastructure and AI-specific products have spurred a new wave of adoption in the manufacturing industry. The convergence of more robust computer platforms, more powerful communication networks and datasets large enough for AI engines to process data in meaningful ways has resulted in the creation of better conditions for AI adoption. In addition, breakthrough AI products, such as OpenAI's ChatGPT, have captured the imagination of the industry as well as the public at large, for better or worse.

A new wave of overall adoption is evidenced in the survey findings and in what kinds of projects manufacturers are conducting. Today, 57% of respondents indicate that their companies are experimenting with a range of small-scale pilot projects in various areas of the business. Another 28% say they have implemented projects operationally that have passed the pilot stage (Chart 1).

TWENTY EIGHT PERCENT ALREADY HAVE OPERATIONAL AI PROJECTS IN PLACE, BUT IT'S STILL EARLY DAYS IN AI ADOPTION FOR MOST

What is the overall progress level for AI across your company? (all that apply)

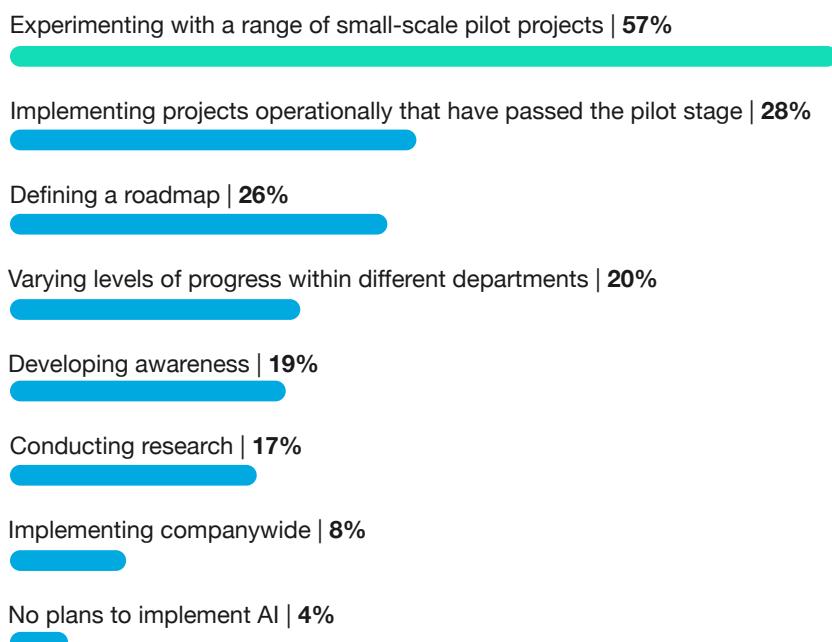


Chart 1

The top corporate functions that have begun the adoption of AI are manufacturing and production, inventory management, and R&D and quality operations. Corporate functions such as finance, sales and marketing, and human resources garner only single-digit responses in terms of AI adoption today (Chart 2). As a result, how manufacturing operations implement AI may serve as a role model for other functional areas in manufacturing companies.

MANUFACTURING AND PRODUCTION TOP THE LIST OF CORPORATE AI IMPLEMENTATIONS

Which of the following corporate functions has begun the adoption of AI? (all that apply)

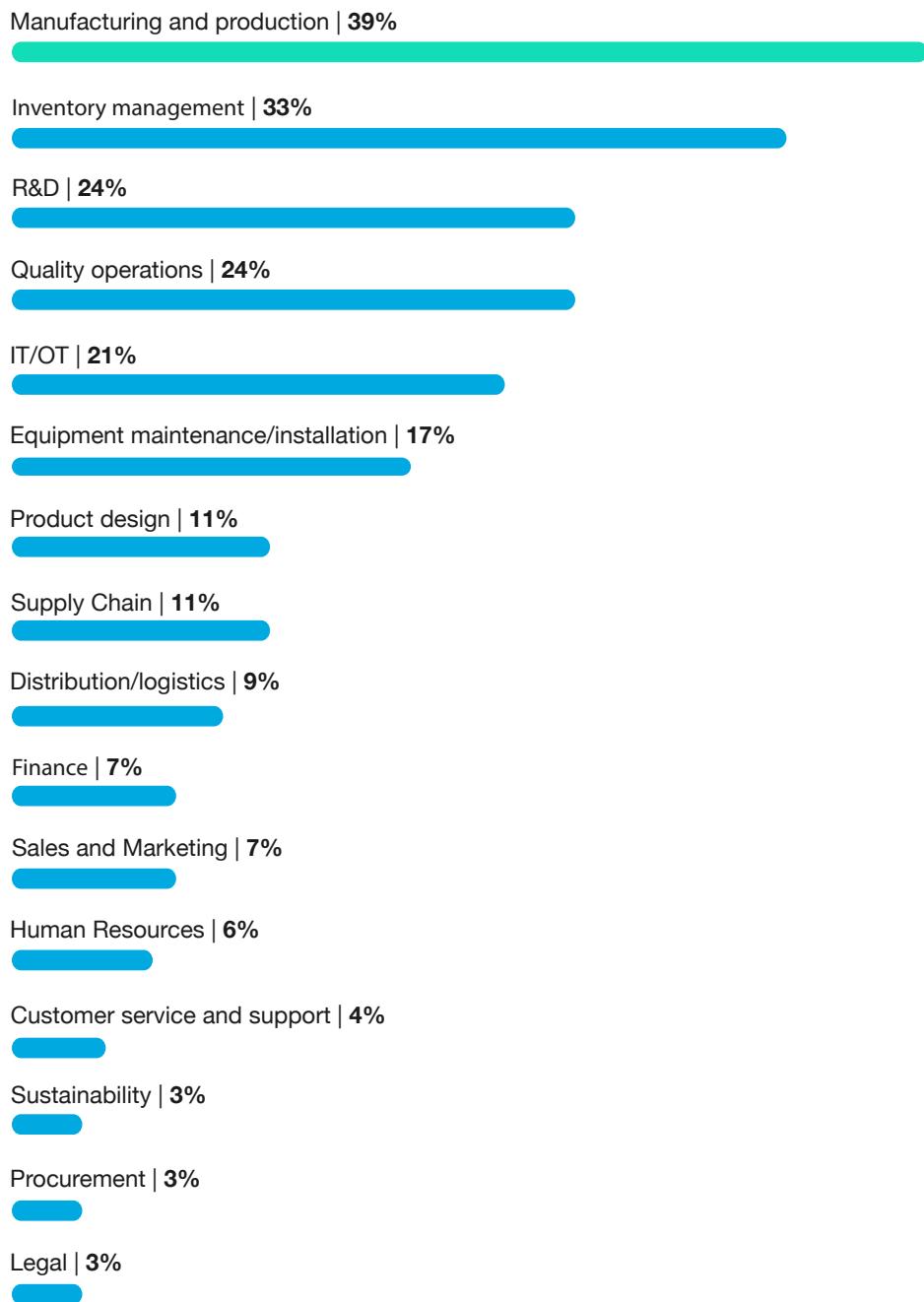
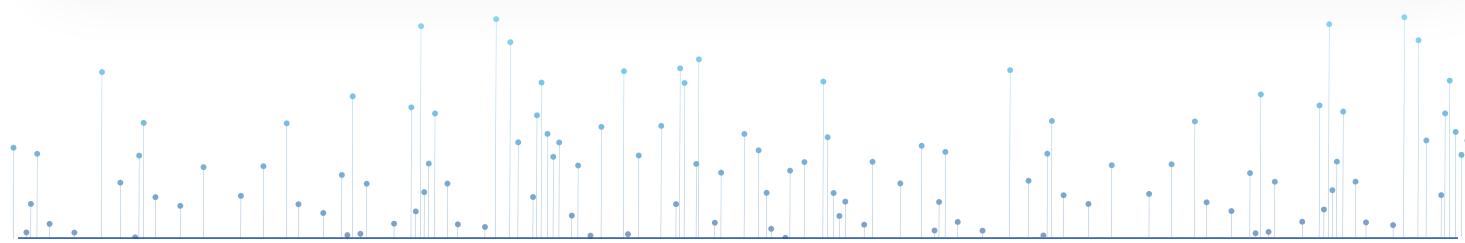


Chart 2



At the plant floor operations level, 39% of survey respondents are in pilot mode with AI projects, but another 23% say their projects have progressed beyond the pilot stage (Chart 3). This may indicate that some have avoided what is known as “pilot purgatory,” a common affliction with some digital transformation projects. The most significant application areas on the plant floor operations level, according to the survey, are in IoT analysis, preventative maintenance of plant floor equipment and in process improvements (Chart 4).

MANY ARE STILL ROADMAPPING OR PILOTING AI IN MANUFACTURING

What is the progress level of AI adoption in your plants and factory operations?
(All that apply)

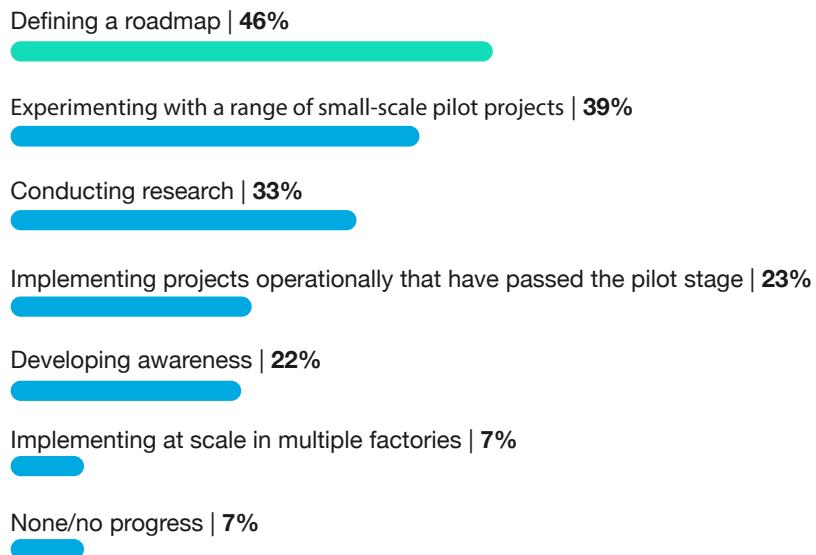


Chart 3

PLANT FLOOR IoT ANALYSIS AND PREVENTATIVE MAINTENANCE ARE PRIMARY AI APPLICATION AREAS

What are the key application areas for AI technologies in your plants and factories?
(All that apply)

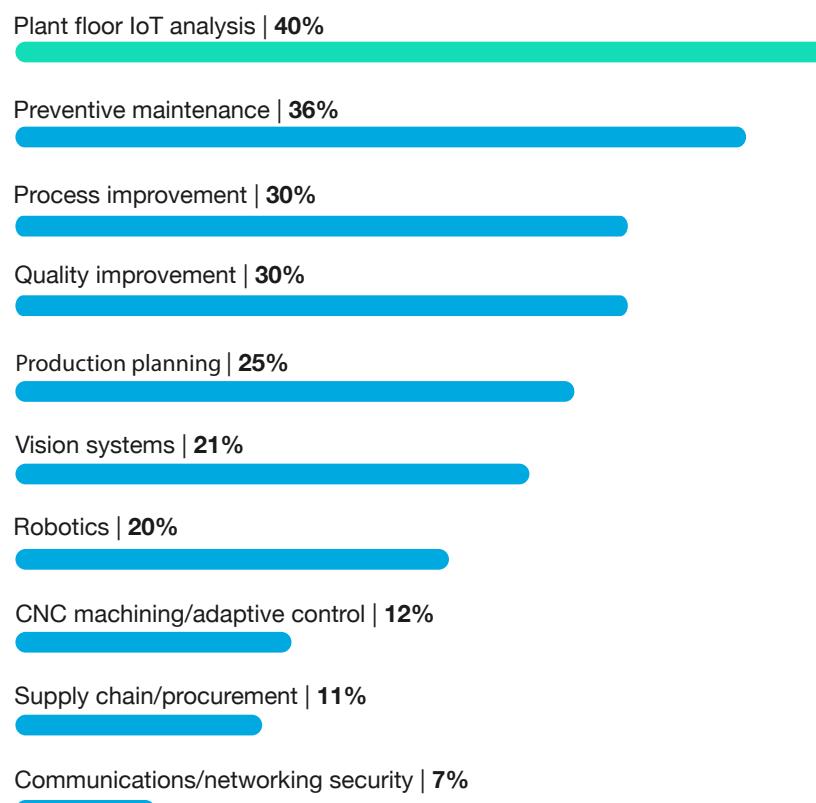


Chart 4

Looking ahead, almost all manufacturers expect to increase AI investments in operations by 2030, with 20% saying they expect investments to increase 50% to more than 100% in the coming years (Chart 5). Assuming these investments take place, AI adoption and usage in operations is slated to increase substantially in the years ahead, raising implications for workforce size and skill set composition as well as the extent to which factories and plants will be automated.

LEVELS OF MANUFACTURING AI INVESTMENT PREDICTED TO RISE IN 96% OF COMPANIES BY 2030

What level of increase in overall AI investments do you plan, or expect to see, in your manufacturing operations by 2030?

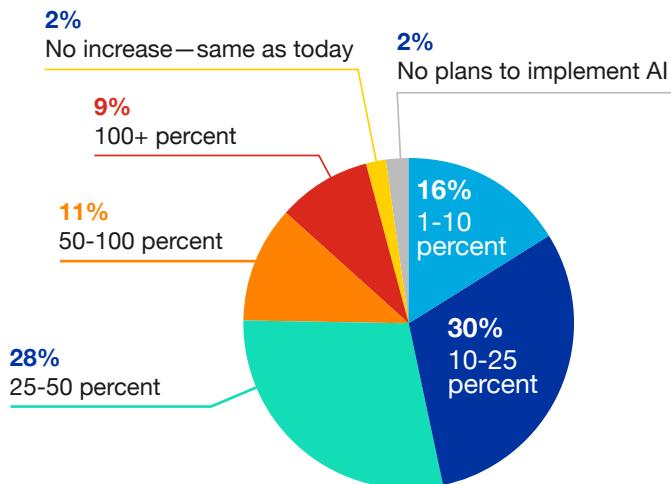


Chart 5

Already, 40% of survey respondents expect that plants and factories will be run largely autonomously by 2030, although they say that people will still play an important role in the operations of their facilities. Twenty percent expect that some factories and plants will become fully autonomous, but only 2% at this point expect a scenario where all plants and factories will become fully autonomous (Chart 6).

AUTONOMOUS FACTORIES TO INCREASE BY 2030, BUT PEOPLE WILL STILL PLAY A KEY ROLE

Which statement would best describe your expectation about the state of future factories and plants as the result of the use of AI by 2030?

- All factories and plants will become fully autonomous | 2% ●
- All factories and plants will become largely autonomous, but people will still play a significant role | 40% _____
- Only some factories and plants will become fully autonomous | 20% _____
- Only some factories and plants will become largely autonomous, but people will still play a significant role | 21% _____
- Factories and plants will become more highly automated, but autonomous operations are a long way off | 17% _____

Chart 6

SECTION 2

AI STRATEGY AND ORGANIZATION

Even as they go forward with their AI investments and projects, manufacturers are evidently still ramping up their AI expertise and confidence levels. A slight majority, 51% of survey respondents, say they have a moderate level of confidence in their companies' internal expertise to manage and support AI implementations successfully, but only 8% indicate a high level of confidence. This is not surprising given the time and effort required to develop knowledge, expertise and experience with AI, but it may also indicate that some companies do not have sufficient AI expertise skill sets in their workforces. Competition for AI talent—not only within manufacturing, but across all industries—is intense.

Underscoring the expertise issue is the finding that only a small percentage of survey respondents say internal AI teams are the primary source of support for the development of AI competencies in their organizations. Software providers and automation vendors are instead filling that role in many companies.

These limitations could also be affecting the degree to which survey respondents think AI will be important to their businesses by 2030. When asked about AI's business impact today and by 2030, 19% attached a high level of importance to the technology today, rising to 27% by 2030. Clearly, AI technology has not crossed the chasm to mainstream management philosophy at this point, but as more experience is gained and more results presumably achieved, perceptions about the role of AI in the success of their business may change.

Certainly, a key factor that will propel AI's adoption, and the attitudes surrounding its usage, will be the competitive dynamic. An important finding of the survey in this regard is that a substantial number of survey respondents, 43%, feel their companies are behind competitors in the use of the technology. Only 16% assessed themselves ahead of their competition, while 30% see themselves on par with their competitors.

To accelerate AI adoption and exploit it competitively, manufacturers will have to improve how they are organized around the AI opportunity. Right now, the survey indicates that there may be a lack of internal coordination around AI at some companies.

For example, 51% of survey respondents said that their AI initiatives are not part of their company's overall digital transformation strategy, a curious finding given the role that data, and the AI engines necessary to process and analyze it, plays in such strategic undertakings. Only 36% said their AI initiatives are indeed part of broader digital transformation campaigns (Chart 7).

**ONLY ONE-THIRD
CURRENTLY REGARD
AI AS PART OF
THEIR DIGITAL
TRANSFORMATION
STRATEGY**

Are your AI initiatives
part of a larger digital
transformation strategy?

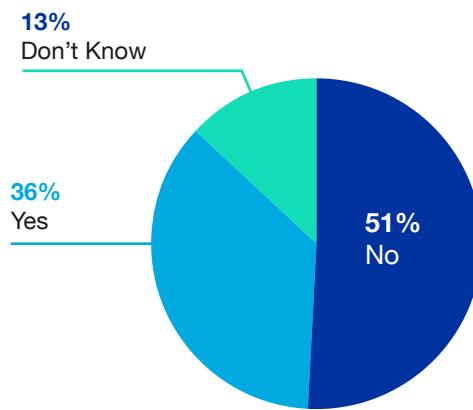


Chart 7

Part of the reason for the disconnect may be that, organizationally, the most respondents, 43%, say that individual business units and divisions are devising their own AI plans. Only 29% say there is a formal corporate plan and strategy in place for AI.

And organizational responsibility for AI appears quite diffuse at this stage of adoption in many companies. For example, 34% of respondents said the head of manufacturing is in charge of AI efforts, while 21% indicate it is the head of corporate IT. Only 10% identified a chief digital officer or chief data analytics officer as being in the driver's seat on AI projects.

As AI activity increasingly moves beyond the pilot stage and into broader enterprise projects and deployments, greater organizational coordination and clearer lines of responsibility will most likely emerge.



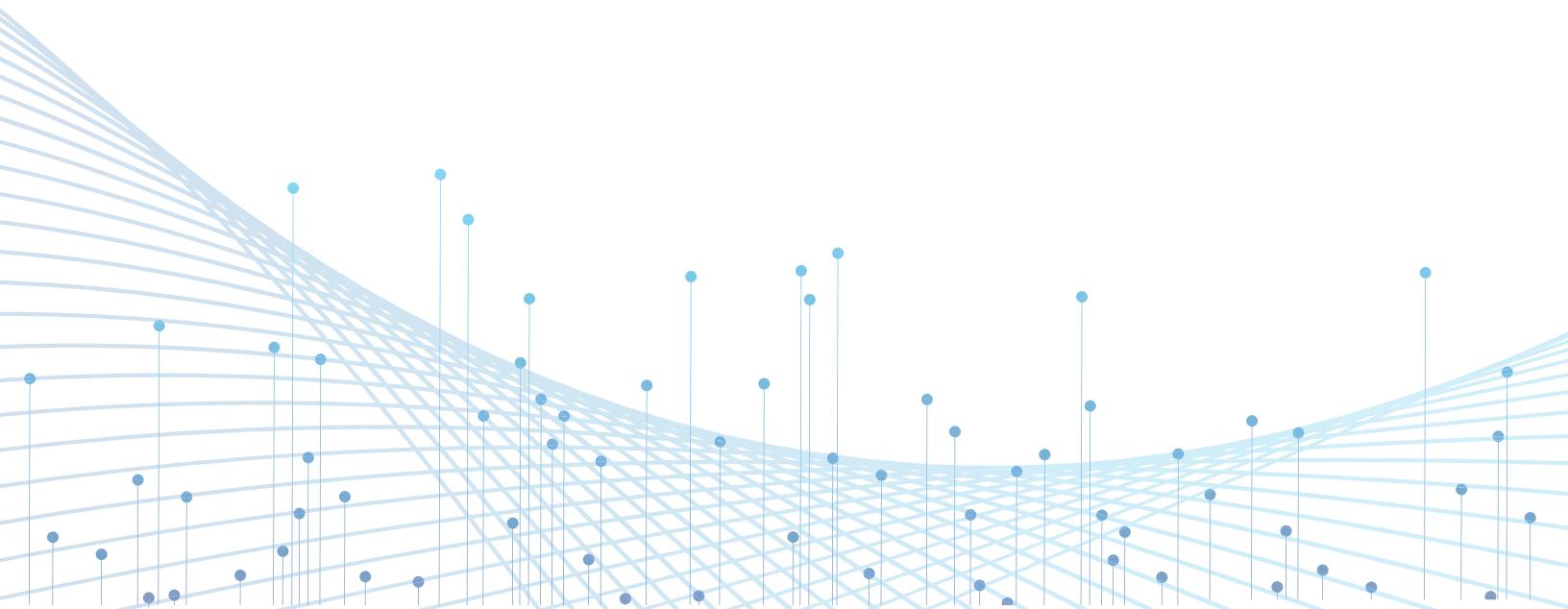
SECTION 3

BENEFITS OF AI ADOPTION

When it comes to AI's benefits, it should come as no surprise that there is a consistent belief that it will have moderate or high-potential benefits in several key areas related to overall business performance, production operations and supply chain functions. Interestingly, however, in each area, there is no one or two benefits that could be considered breakthrough advantages. In each area, respondents see a set of potential benefits that are not yet clearly differentiated.

In fact, the survey canvassed 14 areas related to overall business performance where AI might provide a benefit, eight production operations areas and nine supply chain areas. In every instance, at least 70% of respondents said AI would have a high or moderate benefit.

Regarding the potential benefits of AI adoption for the overall business, leading the way in the high-impact category were better decision making, cost savings, better planning and increased competitive advantage. But each of these benefits were cited by one-third or slightly more than one-third of respondents. No benefit among the 14 response options received a near majority or an actual majority share of responses. This suggests that manufacturers—at least at this stage of AI adoption—foresee a set of benefits they cannot yet accurately quantify at this point in time but could as AI experience and knowledge increases (Chart 8).



AI EXPECTED TO DRIVE BETTER DECISION MAKING AND COST SAVINGS ACROSS THE ENTERPRISE

How would you assess the potential benefits of AI adoption for your overall business?

- High
- Moderate
- Low

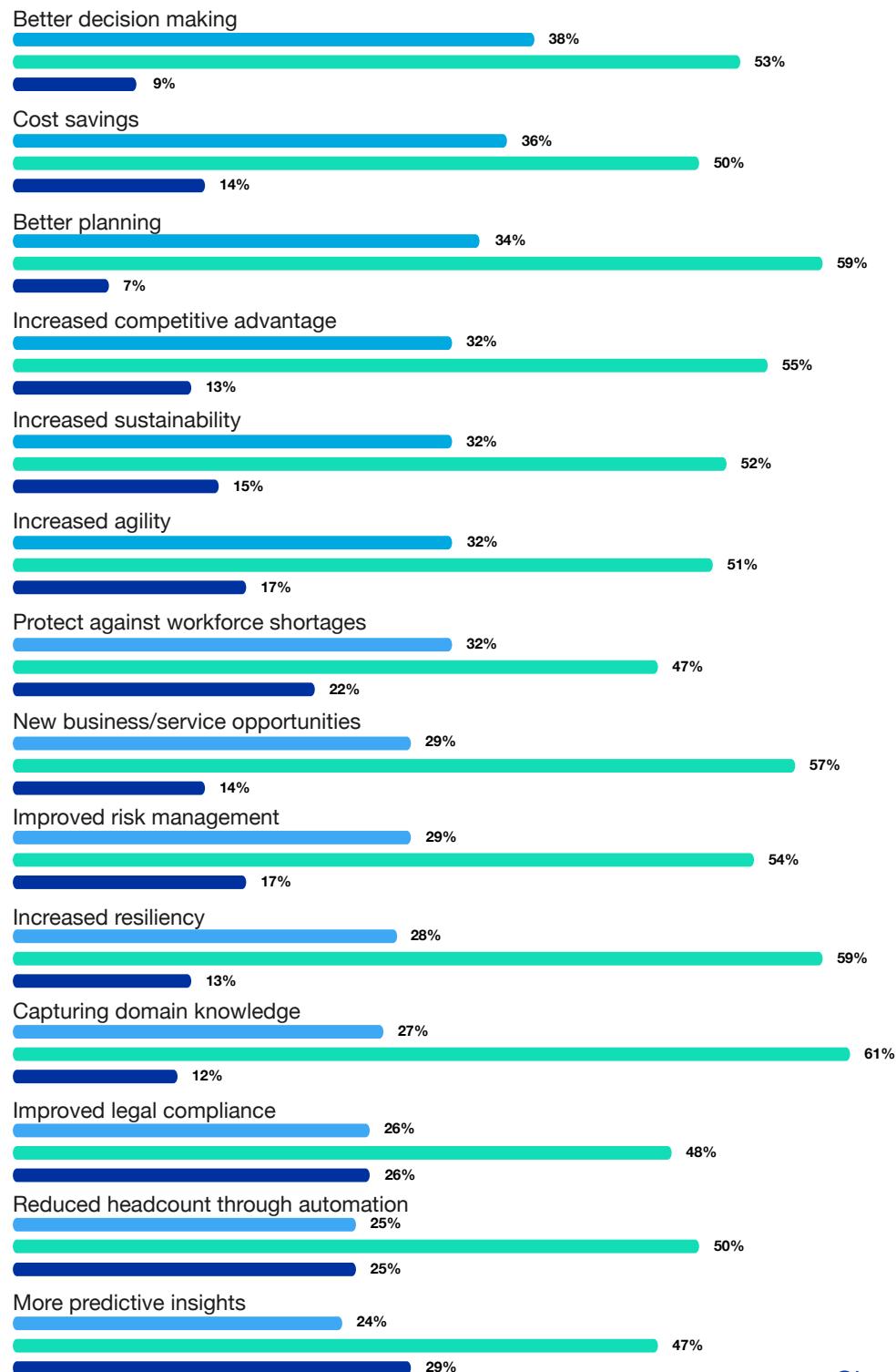


Chart 8

The same dynamic was in play with expected benefits for production operations and supply chain operations. In the former, improved predictive maintenance is the area that most respondents, 43%, see as the ripest for potential benefits of AI adoption. And coming in at second and third place were more sustainable production operations and innovations in the production process itself. But even benefits such as more secure plant floor networking and faster time to market of products were cited by 27% and 23% of respondents, respectively (Chart 9).

PRODUCTION OPERATIONS EXPECTED TO BENEFIT MOST FROM IMPROVED PREDICTIVE MAINTENANCE, SUSTAINABILITY, AND INNOVATION

How would you assess the potential benefits of AI adoption for your production operations?

- High
- Moderate
- Low

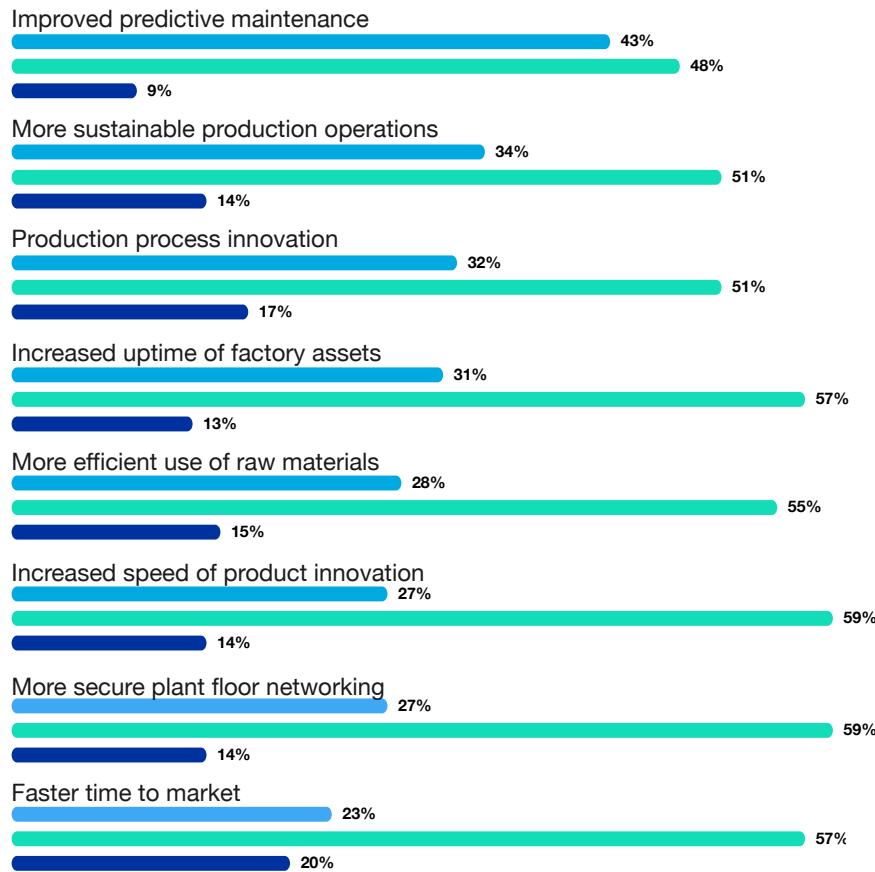


Chart 9

And in the supply chain realm, better visibility, increased agility and better planning each scored about one-third or more of respondents, suggesting once again that manufacturers expect a set of benefits each of which is close in value (Chart 10).

VISIBILITY, AGILITY, AND PLANNING SEEN AS KEY SUPPLY CHAIN BENEFITS

How would you assess the potential benefits of AI adoption for your supply chain?

- High
- Moderate
- Low

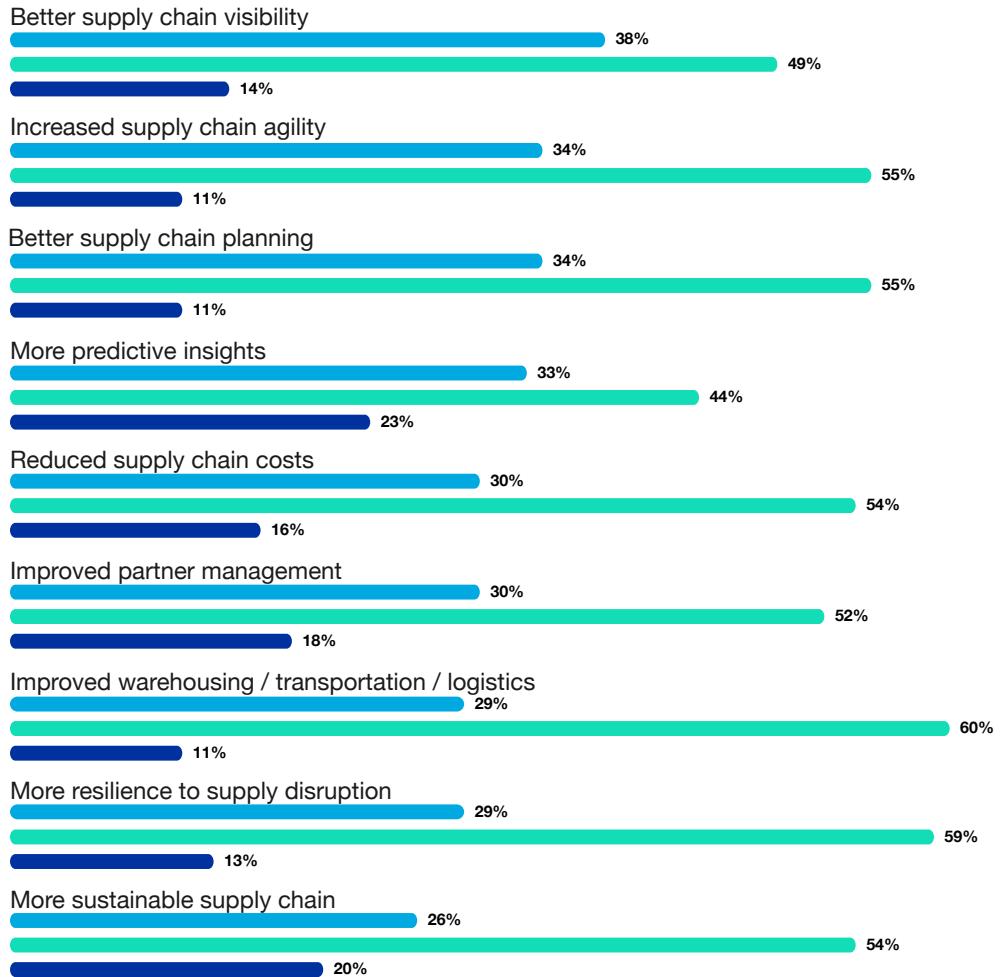


Chart 10



SECTION 4

MEASURING AI IMPACT

Perhaps also reflecting AI's current level of usage, how organizations measure its effectiveness is still in an early stage. Just 22% of respondents have a specific set of metrics in place to measure AI deployments' effectiveness and impact. That leaves 61% reporting no metrics are in place and 17% reporting they do not even know if metrics exist (Chart 11).

**ALMOST
TWO-THIRDS
STILL DON'T HAVE
SPECIFIC METRICS
TO MEASURE
AI IMPACT**

Do you use a specific set of metrics to measure the effectiveness/impact of your AI deployments?

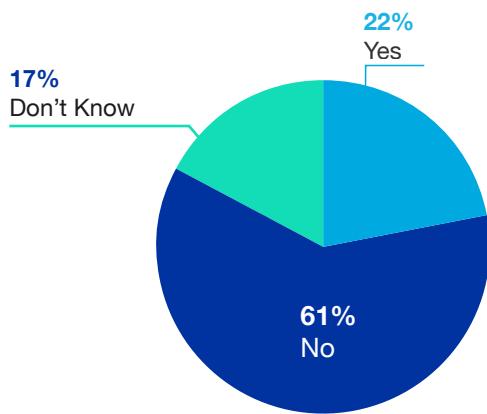


Chart 11

Of those reporting that their organization has AI effectiveness metrics in place, 35% say they are measuring asset availability, 33% are measuring quality of results and 27% are measuring unexpected insights (Chart 12).

The development of metrics will be an important step forward for many organizations as they plan to increase their AI usage. They will need acceptable metrics to establish the business case for pilot and broader AI projects, including return on investment statistics.

CURRENTLY, AI METRICS ARE MOSTLY FOCUSED ON ASSET AVAILABILITY, QUALITY OF RESULTS, AND UNEXPECTED INSIGHTS

If 'Yes', what measures are included in the metrics you use? (All that apply)

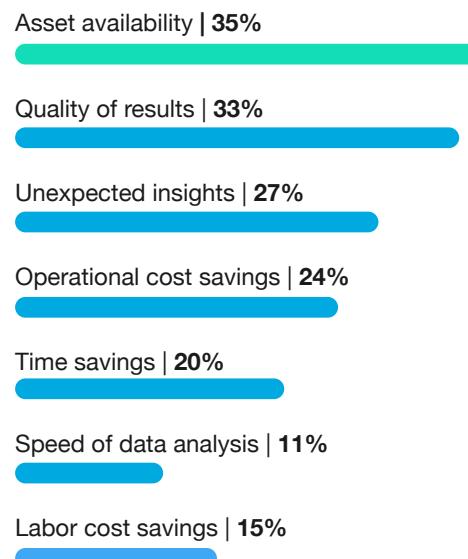


Chart 12

SECTION 5

CHALLENGES TO AI ADOPTION

When queried about AI adoption challenges, the dynamic seen regarding expected benefits—a cluster or set of factors with more or less the same significance — was nowhere in sight. A strong majority of survey respondents, 65%, was quite clear what the biggest culprit to adoption is: data.

The components of this issue include challenges in accessing data, formatting data, integrating disparate sets of data, data privacy and even what governance rules are in place in manufacturing organizations. The data issue is 22 points ahead of the second-place issue, a lack of appropriate AI skills in the workforce. Clearly, many manufacturers need more people skilled in AI data management, the survey suggests.

Coming in third and fourth in terms of challenges to overall AI adoption, at 40% and 37%, respectively, were understanding AI's business case and the need to upgrade legacy equipment. Without clear or any metrics in place to measure the value of AI, it is no surprise that understanding the business case remains a challenge (Chart 13).

DATA ISSUES DOMINATE THE CHALLENGES OF AI ADOPTION

What do you see as the biggest challenges to AI adoption in your organization today? (Top 3)

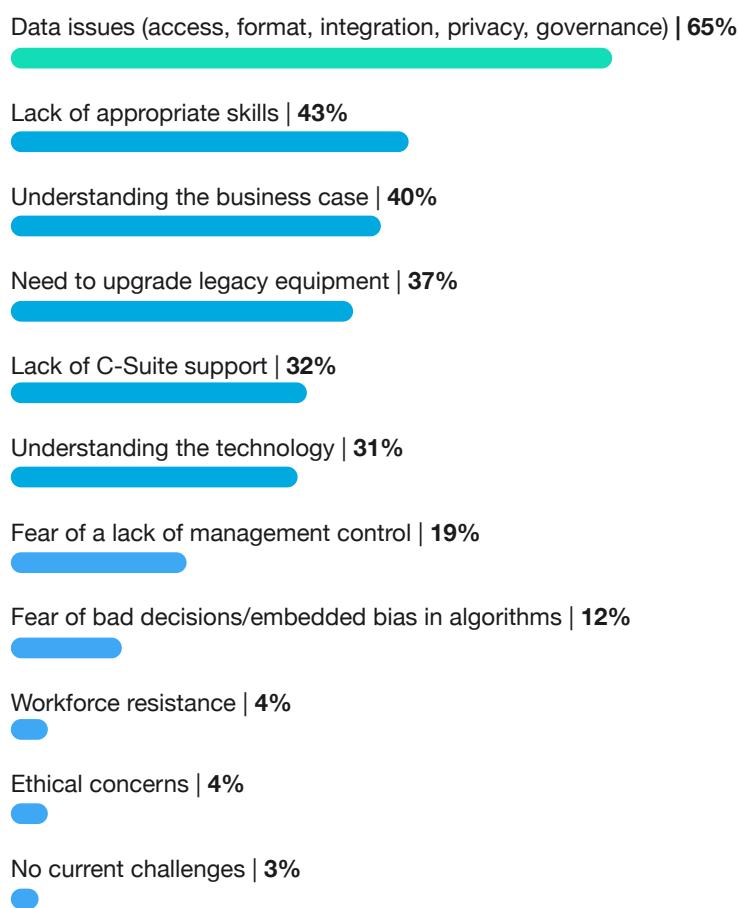


Chart 13

Diving deeper into the data issue, the survey asked participants to identify their top three most challenging areas of working with AI-related data. Data contextualization was identified by just over half of respondents. Contextualization's dominant position in the results indicates that respondents are concerned about the challenges of making data actionable. Ironically, AI technologies, themselves, may provide a seamless way to contextualize the data to solve this challenge. Validation, at 32% of the sample; noisy data, also at 32%; poor quality data, at 30%; and computation, at 30%, round out the leading challenges, but lag far behind respondents' concerns about contextualization (Chart 14).

UNDERSTANDING DATA'S CONTEXT IS THE BIGGEST AI DATA CHALLENGE

What areas of working with AI-related data are proving most challenging? (Top 3)

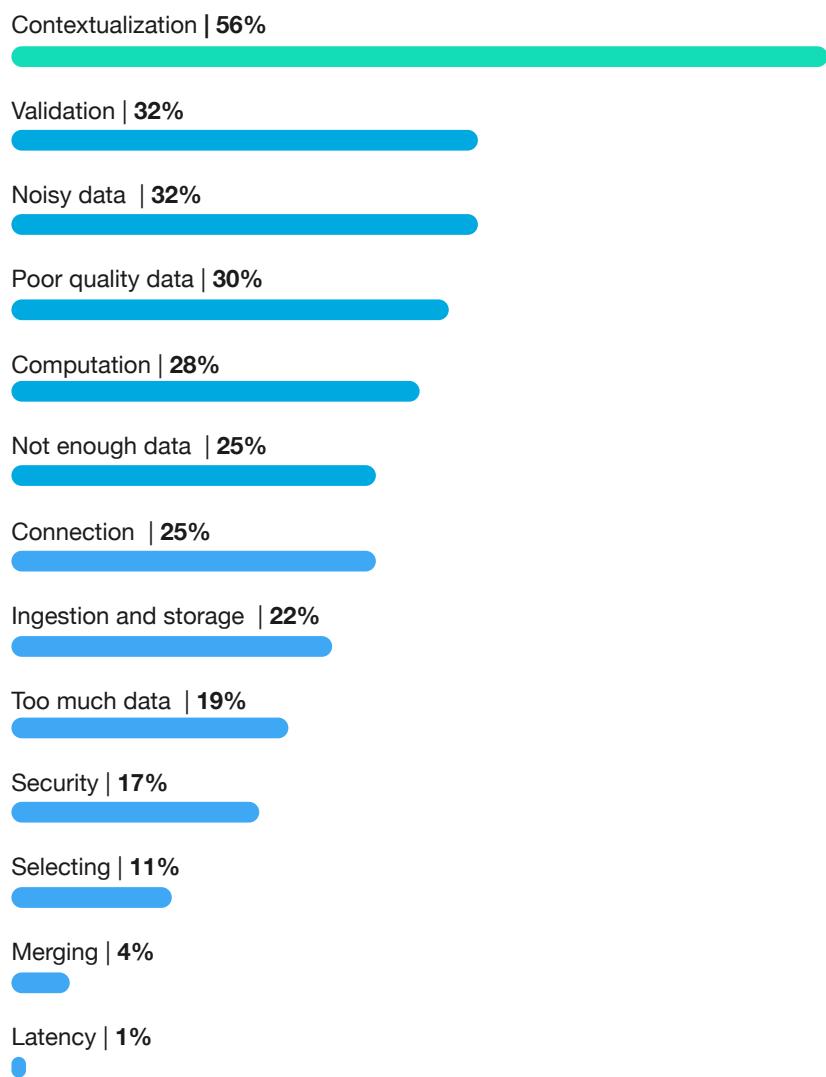


Chart 14

SECTION 6

WORKFORCE IMPACT

One of the major concerns often voiced about the acceleration of AI's adoption in manufacturing is that such a pervasive technology will inevitably replace workers and remove much-needed jobs from the nation's industrial economy. Others, however, argue that AI should not be viewed as a problem, but as an opportunity for manufacturers to help fill the significant skills gap the industry has been struggling with over many years.

For example, the U.S. Bureau of Labor Statistics estimates that there were around 693,000 unfilled manufacturing job openings in March, compared to an overall U.S. manufacturing workforce of 12.9 million. Unfilled jobs is a major issue for many manufacturers striving to grow as they must now compete for much-needed talent, especially valuable digital talent, against multiple other industries and from a finite pool of available workers.

Yet, the MLC's latest research tells a slightly more nuanced story. A substantial 45% of respondents predict that their workforce headcount will not be affected at all by the increased adoption of AI by 2030 (Chart 15). Only 21%—one in five companies—suggest their workforce is likely to decrease as a result.

ONE-THIRD EXPECT THEIR WORKFORCE HEADCOUNT TO INCREASE DUE TO AI

What impact do you think AI will have on your workforce headcount by 2030?

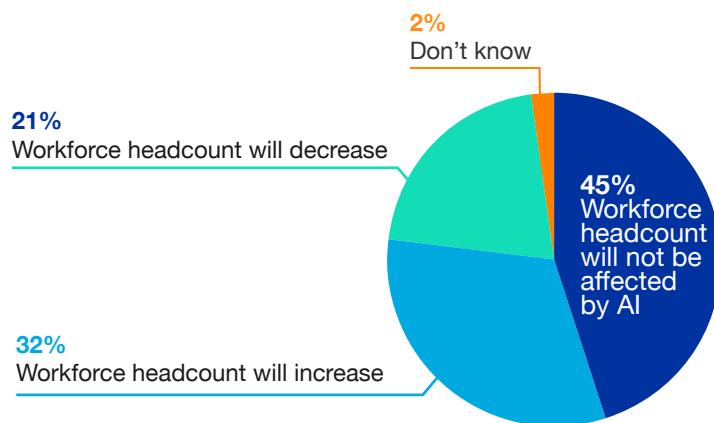


Chart 15

Perhaps more interestingly, though, 32% expect AI's impact to actively increase their need for more workers in the future, not decrease it, potentially generating new roles and helping to spur expansion and growth.

What is certain, however, is that many of those future manufacturing jobs will not be the same as they have been in years gone by. Ninety-five percent of the companies responding to the survey expect to retrain or reassign at least a portion of their workforce as a result of increased AI adoption (Chart 16).

ONE-THIRD EXPECT TO RETRAIN OR REASSIGN OVER 10% OF THEIR WORKFORCE DUE TO AI

What percentage of the workforce displaced by AI adoption do you expect to be retrained or reassigned for other roles in your company by 2030?

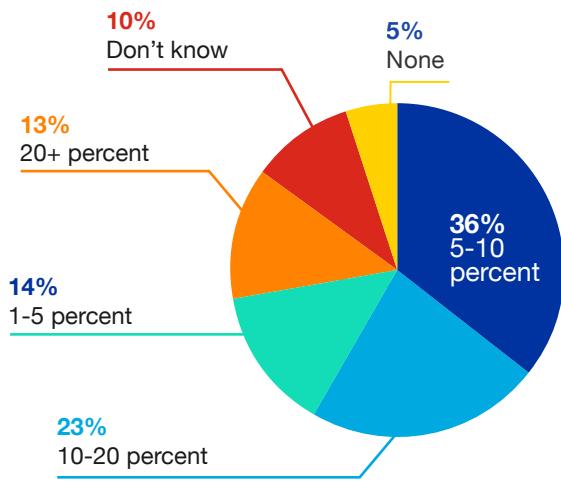


Chart 16

In some cases, this may mean retraining or reassigning 20% or more of their workers who may be displaced by AI, a possibility cited by 13% of respondents, although the majority put that retraining percentage lower, with 23% of respondents expecting to retrain between 10% and 20% of workers, and 36% retraining or reassigning between 5% and 10%. Only a mere 5% expect no AI-impacted worker retraining will be required.

Perhaps of more concern for the future, though, is that while so many companies expect some form of retraining over the next few years, and despite rising future adoption forecasts, the majority of manufacturing companies have still yet to assign any specific budgets to provide that direct AI technology training and education for their workforce (Chart 17). Just one in five have already made some AI training provisions, but a substantial 65%—almost two-thirds of respondents—say they have no workforce AI training budgets in place.

TWO-THIRDS STILL HAVE NO DEDICATED BUDGET FOR AI TRAINING

Does a dedicated budget exist within your company for AI technology training and education?

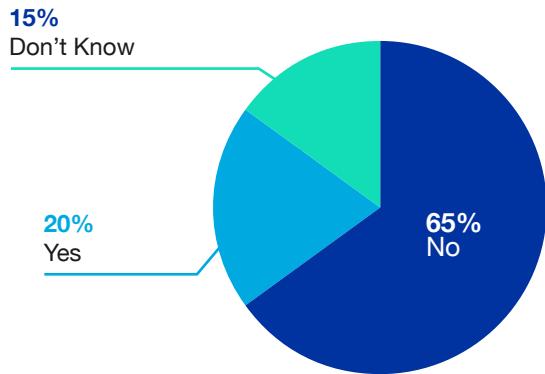


Chart 17

As industrial adoption rates increase, however, and AI and machine learning technologies become more pervasive across both operational and enterprise functions, the expectation is that this situation is likely to change significantly as the industry approaches 2030.

SECTION 7

AI ETHICS

Concerns about the influence that increasingly intelligent technologies like AI may have on human societies, and individual freedoms, are not new. Science fiction writers like Isaac Asimov and computer scientists including MIT's Norbert Wiener were raising these issues back in the 1940s.

However, recent developments—coupled with rising adoption and the impact that new generative AI systems, such as ChatGPT, are predicted to have over the next few years—have led to a new burst of questioning about how societies can best ensure these increasingly sophisticated systems can be developed and applied successfully while remaining safe, ethical, unbiased, socially responsible and trusted.

Such concerns have become a hot topic of debate recently among politicians, government agencies, leading technology industrialists and scientists around the world. For industrial companies, this raises the key question of whether there is now the need for a code of ethics for the way AI systems are developed and used in industrial operations and activities.

MLC survey respondents, however, are split evenly on whether the industry needs to pursue such a future ethical course, with 44% for, and 45% against (Chart 18).

MANUFACTURERS SPLIT ON NEED FOR AN AI CODE OF ETHICS

As AI grows in sophistication do you believe that manufacturers should adopt a code of ethics or conduct for its use?

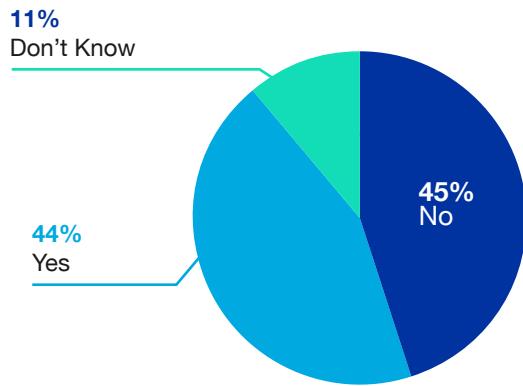


Chart 18

What is clear, though, is that if an AI code of ethics is going to be developed for the future, industrial companies must play a central role in determining what is involved. Thirty-nine percent of respondents say it should simply be left to individual companies, themselves, to develop their own codes, 22% favor cross-industry collaborative groups and 31% believe the best approach would be a broader initiative involving industry, government and leading academics (Chart 19). Only 3% want to leave the task to governments alone.

TWO IN FIVE BELIEVE AI ETHICS SHOULD BE LEFT TO INDIVIDUAL COMPANIES

If yes, how should a code of AI ethics or conduct be devised in manufacturing?

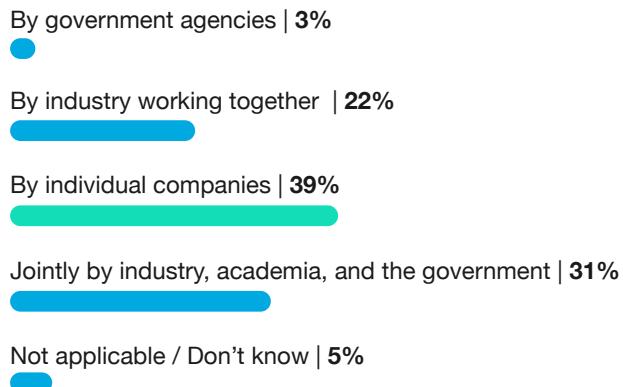


Chart 19

Once again, respondents are split evenly on whether that code of ethics should then constitute a federal-level industrial AI policy in the U.S., mirroring approaches already underway in Europe and other parts of the world. While 45% feel the U.S. does need a federal-level industrial AI policy, an equal 45% do not believe that is necessary (Chart 20).

MANUFACTURERS SPLIT ON NEED FOR FEDERAL U.S. AI POLICY

Given the global competition in AI currently underway, do you think the U.S. needs a federal-level industrial policy on AI?

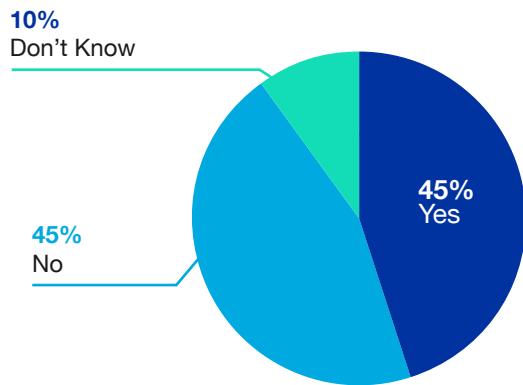


Chart 20

It will be interesting to watch how this debate develops in the years ahead, especially as manufacturers with global operations serving multiple global markets try to balance different approaches as they strive to be compliant in different geographical regions where local AI codes of conduct may differ.

SECTION 8

FUTURE IMPACT ON MANUFACTURING

Whatever strategic changes, operational transformations, workforce implications or ethical approaches ultimately emerge, it is clear that AI is here to stay in manufacturing and will become more pervasive and influential than ever by 2030.

For 41% of respondents, the impact that such a massive increase in AI adoption will have on the future of manufacturing will be extremely significant, helping to improve operations, efficiency and competitiveness radically (Chart 21).

FIFTY-NINE PERCENT SEE AI AS SIGNIFICANT OR GAME CHANGING FOR THE FUTURE OF MANUFACTURING

Ultimately, how significant an impact will AI have on the manufacturing industry in 2030 and beyond?

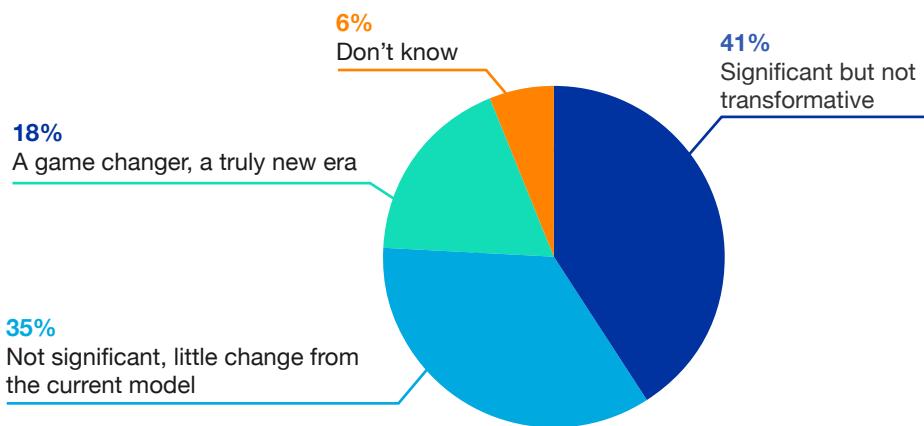


Chart 21

More than one-third, however, are still not yet convinced it will make much difference, with 35% saying there will be little change from the current model.

But for 18% of survey respondents, that future impact of AI in manufacturing will be game-changing, transforming the way the industry operates across multiple levels, from the nature of the products it creates, to how those products are produced, to the way they are used, to what happens to them at end-of-life, to how entire business enterprises are structured, managed and led.

In every technology revolution, there are always leaders, followers and those who get left behind. While many current perspectives on the future of AI exist, it behooves all manufacturing industry leaders to understand more about the fundamental AI transition now underway and to ensure they manage that transition successfully in the years ahead to 2030.

CONCLUSION

As the industry approaches 2030, AI technology will evolve to play a central role in how manufacturing companies manage their production operations, devise their workforce skills inventories and define their competitiveness.

The key to unlocking the true value of Manufacturing 4.0 is the ability to gather, organize, analyze and use information from all facets of manufacturing to not only produce a step change in efficiency, cost effectiveness and productivity, but also to enable business model innovation that can enhance value creation. AI is poised to help move the industry to this higher plane.

But this future state will not come without answering many tough questions and dealing with many complex challenges, some of them centering on trust of the technology. Chief among them are issues around the degree of AI-powered autonomous operations, AI's impact on the manufacturing workforce and whether a code of ethics is necessary for AI's responsible use.

Already, as this survey indicates, many manufacturers are envisioning that their operations will become more highly automated and even achieve a significant degree of autonomy using AI, although few see a fully lights-out scenario developing. But the question to be dealt with as the industry moves forward with AI is this: as the technology becomes more capable in the future, how far should manufacturers move toward autonomous operations?

On the workforce front, the survey indicates that there is a significant need for manufacturers to attract AI expertise and that few today have the requisite skill sets internally to take advantage of the technology. Most rely today on their software and service providers for AI expertise. The questions to be dealt with are these: how will the manufacturing industry compete for AI talent against other industries also eager to attract and retain AI expertise and how will AI reshape workforce competency and skills inventories?

And perhaps the biggest and most difficult question of all has to do with whether AI can be used ethically and responsibly. Already, a national narrative has emerged in some quarters that AI is to be feared and that it will create unacceptable disruptions in society. Within the manufacturing industry, the survey indicates, people are split over whether the use of this technology requires a code of ethics, and, if it does, who should devise it.

These are just some of the most significant questions the manufacturing industry will grapple with regarding AI as 2030 approaches. It will take an industry-wide effort to come up with acceptable answers. .



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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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