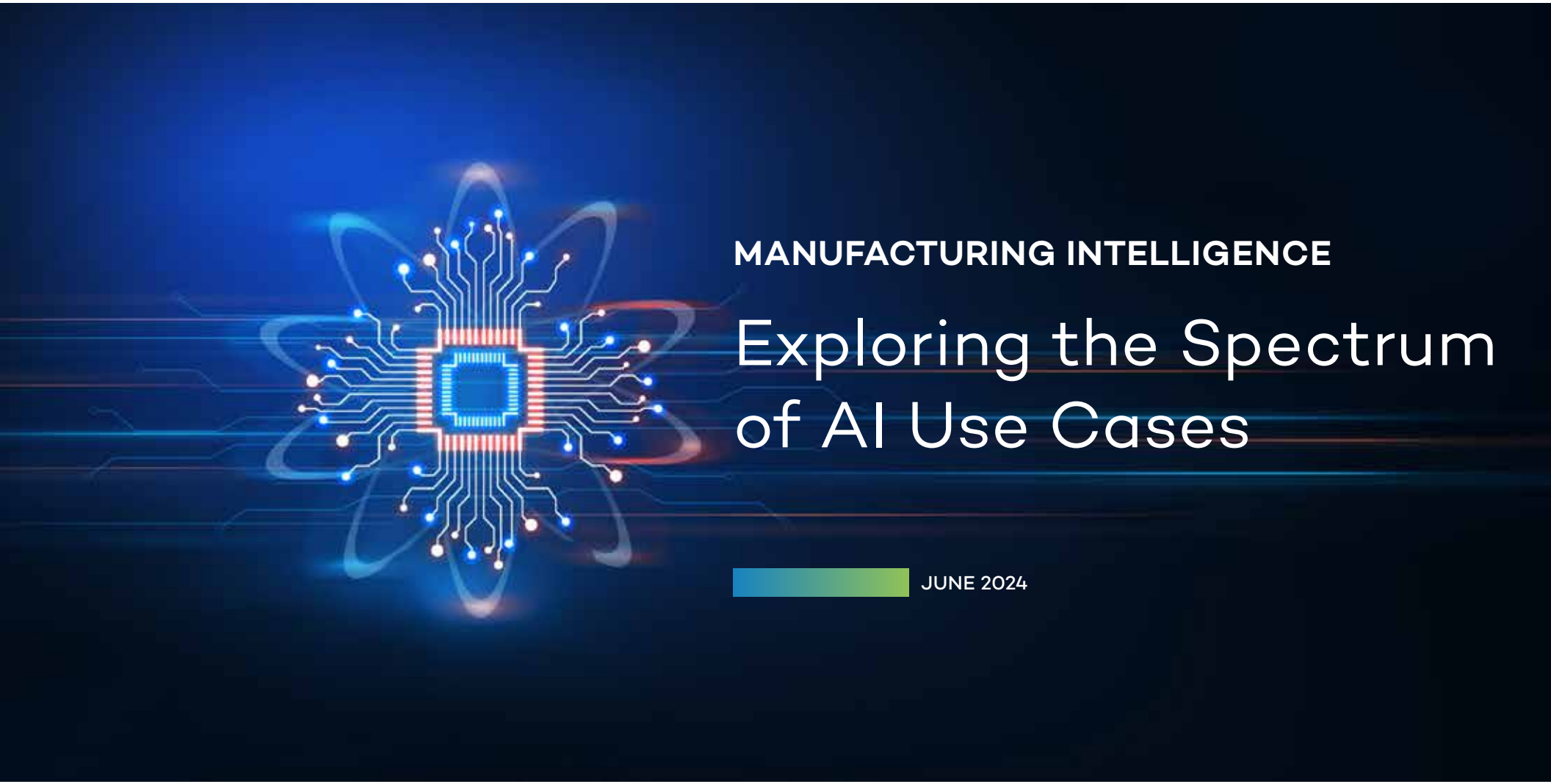
Manufacturers ALLIANCE FOUNDATION



MANUFACTURING INTELLIGENCE

Exploring the Spectrum of AI Use Cases

JUNE 2024

Inside

The Increasing Appetite for AI in Manufacturing

Advances in artificial intelligence (AI) over the last 18 months have put AI on a new trajectory for manufacturing. Of course, the sector is no stranger to AI. Manufacturers have used machine learning for decades to teach equipment to perform tasks, and they are increasingly deploying deep learning to take on more complexity. Significant advancements in generative AI in 2022 opened an entirely new set of opportunities for using AI in the industrial domain. Generative AI is about far more than interacting with chatbots and rewriting essays. Building on deep learning architectures, generative AI can complement a manufacturer's machine learning and deep learning models to add even more intelligence to the entire value stream of manufacturing. All of the advances in AI over the last decade (computer vision, speech recognition, generative AI) combine with other innovations in distributed computing, processing speed, edge computing, and open-source algorithms, to significantly advance manufacturers' journey toward Industry 4.0.

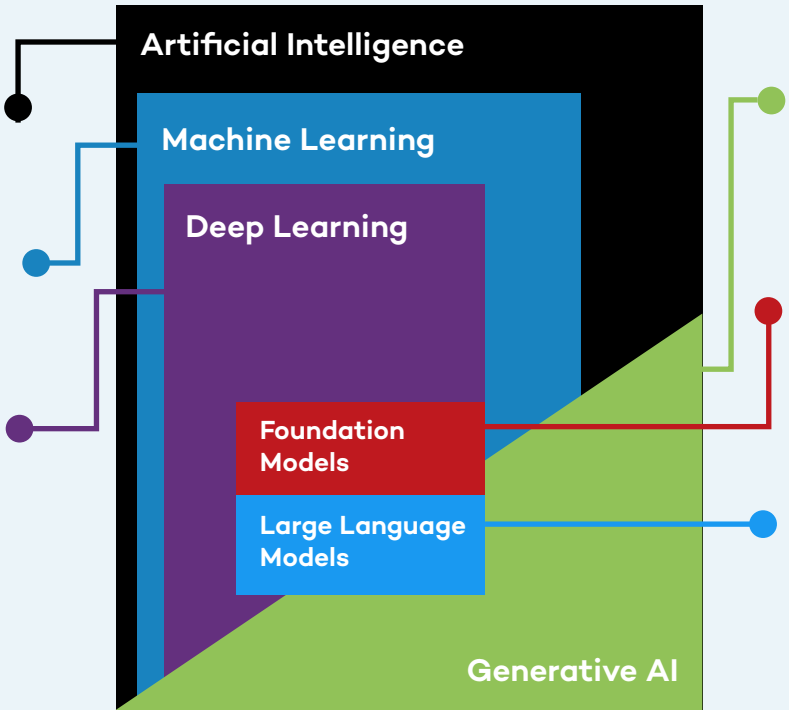
Most companies are early in the process of figuring out where and how to bring cutting-edge AI into their day-to-day operations. As Paul Bouvy, Senior Director of Supply Chain at **Owens Corning**, put it, "We have used AI every day for a long time to control our manufacturing processes. Here, I'm speaking about things like multivariable modeling and problem solving. But nowadays, everyone thinks of AI as just being about generative AI, large language models, and things like that. We're just starting work in that area."

AI Definitions

Artificial Intelligence: Technology that enables computers and machines to simulate human intelligence and problem-solving capabilities.

Machine Learning: A form of AI that enables a system to learn from data rather than through explicit programming.

Deep Learning: A subset of machine learning that uses multi-layered neural networks, called deep neural networks, to simulate the complex decision-making power of the human brain.



Generative AI: Deep-learning models, such as chatbots, that can generate high-quality text, images, and other content based on the data they were trained on.

Foundation Models: Unlike task-specific models previously used by AI, foundation models are trained on a broad set of unlabeled data that can be used for different tasks. Early examples of foundation models are GPT-3, BERT, or DALL-E 2.

Large Language Models: Large language models are a category of foundation models trained on immense amounts of data making them capable of understanding and generating natural language and other types of content to perform a wide range of tasks.

Source: IBM: What's Next in AI?

What are the most important new use cases for AI in manufacturing and how quickly are manufacturers deploying them? Manufacturers Alliance Foundation took a deep dive into these questions to better understand the state of play for AI in manufacturing. We spoke with dozens of leaders across a range of manufacturing functions and conducted a survey of over 200 U.S.-based mid-cap to large-cap manufacturing companies.

KEY FINDINGS reveal a strong appetite for making progress with AI among manufacturing companies across dozens of new use cases already operational today. The vast majority (93%) have added new AI initiatives over the last 12 months, and another 6% plan to launch such initiatives soon. Significantly, many AI initiatives are geared toward strategic business gains, not simply cost or headcount reductions. Many manufacturers expect AI to deliver fairly rapid bottom-line improvements in productivity, throughput, and quality.

"We have just scratched the surface of advanced AI. We're learning how to envision capabilities. Otherwise, we're imposing limits on ourselves for no reason. If you can envision it with AI, you can achieve it."

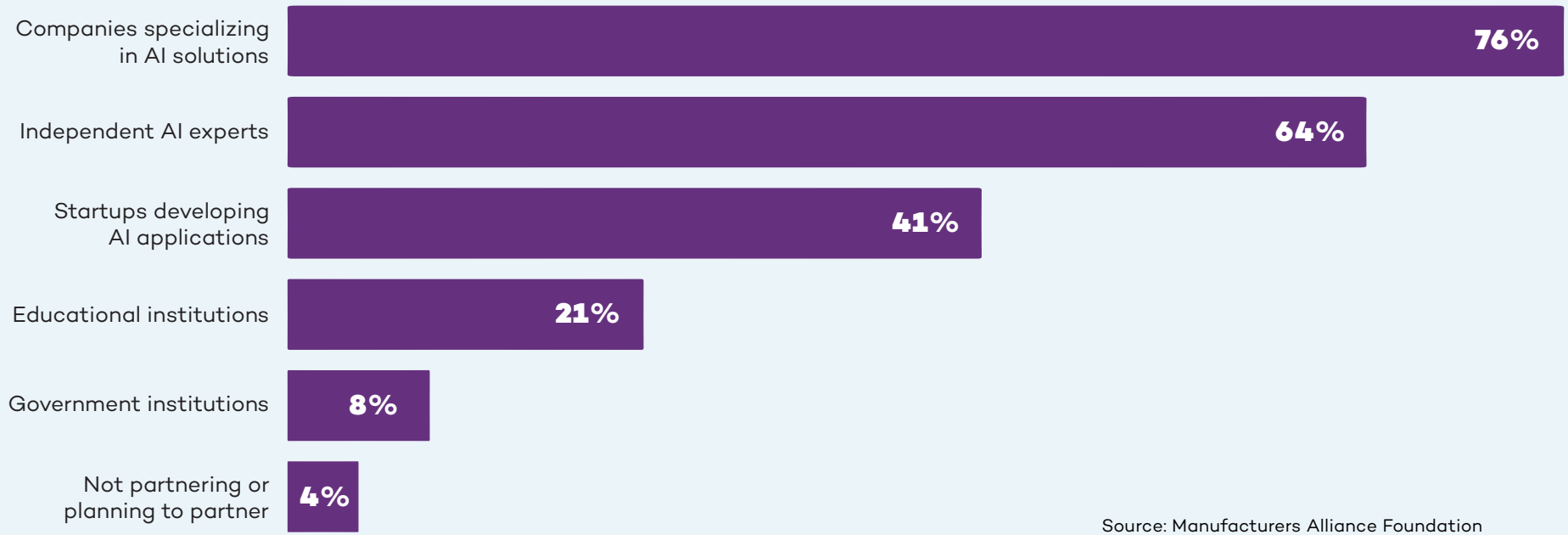
– Katrina Redmond, Executive Vice President and Chief Information Officer, Eaton

The vast majority (93%) have added new AI initiatives over the last 12 months, and another 6% plan to launch such initiatives soon.

The topline benefits, while expected to take more time, are the holy grail. That's why manufacturers have unleashed citizen developers (business users with little to no coding or IT experience) to come up with as many use cases as possible. As Wallas Wiggins, Vice President Global Supply Management and Logistics at **John Deere** told us, "One of the most exciting things is our citizen development effort where we essentially say, 'Hey, go figure out AI. Do something creative, even crazy. If it works, let's scale it across the entire business. We're trying to drill as many holes as possible because one of these days, one of them is going to pop oil."

The AI learning curve is steep for almost every organization. "I think one of the biggest near-term impediments is that you just don't think about using AI, even if you have it," John Bartho, Chief Information Officer at **Hyster-Yale**, told us. Most manufacturers are looking for guidance for the best use cases but more importantly, how to think strategically about AI and fit it into their technology roadmap. As Joanna Cooper, General Manager of the Mount Holly plant for **Daimler Truck North America** put it, "We can't make this technology transition with the attitude that we will do everything on our own. Daimler Truck has a vast number of partnerships with OEMs and other companies, including AI partners. We have to make progress together."

Where Manufacturers Are Partnering



Source: Manufacturers Alliance Foundation

AI for Topline Growth and Competitive Advantage

Finding new and more sophisticated use cases in the age of generative AI creates a new set of opportunities for manufacturers. **McKinsey estimates** that generative AI can contribute between $650 billion and $1.1 trillion in annual productivity improvements for manufacturing and supply chain-related activities globally. With this much to gain, manufacturers are playing the long game when it comes to embracing new applications for AI. When we asked how they are prioritizing their AI initiatives, 55% said they are aligning these initiatives to strategic business objectives. Less than a quarter (24%) are focused on potential cost savings.

Manufacturers see cost as less of an obstacle when topline growth and competitive advantage are at stake. As Tim Speicher, Senior Manager of Advanced Analytics and AI at **MSA Safety**, told us: "The initial value is going to be in productivity, such as saving time. Then there are revenue driving opportunities where AI can help us – either in products or in services – and that's where the excitement comes in." When we asked manufacturers to rank how they plan to measure the ROI of

Top 6 Expectations for ROI

#1	Revenue growth
#2	Improved uptime
#3	Product quality
#4	Customer satisfaction
#5	Long-term strategic impact
#6	Performance relative to industry peers, competitors

Source: Manufacturers Alliance Foundation

their AI implementations, revenue came in as the clear first choice. Long-term strategic impact and competitive advantage against peers ranked fifth and sixth. Cost savings trailed in ninth place.

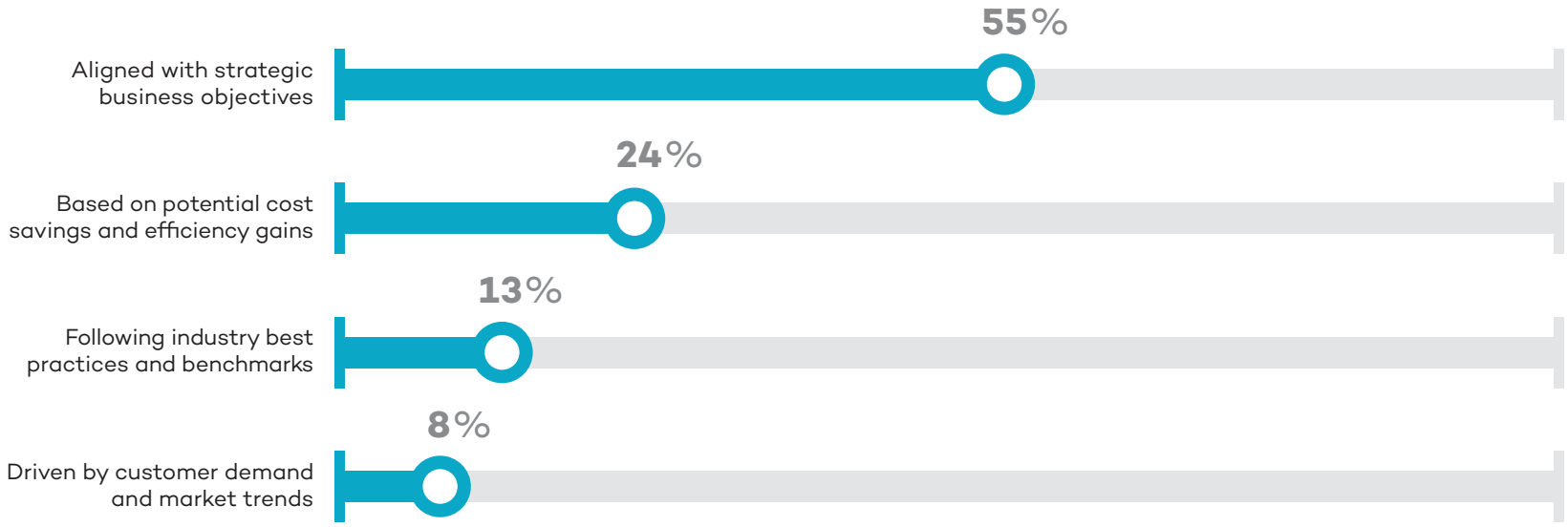
Manufacturers are in it for the long haul. Very few (16%) expect a quick ROI in under 12 months. For the vast majority, the ROI time horizon is farther out: 42% expect to see it within one to two years, and 40% expect two to four years.

Given the magnitude of change, it will take time for organizations to absorb the impact from AI and realize the full benefits. Karen Powers, Digital Product Transformation Leader at John Deere, talked about just this aspect: "I think probably the biggest challenge in general is not determining where we want to use it, but how we build comfort with it. When will people be able to trust the results and allow the system to take action for them? The change management aspect of all of this is huge." Bringing people along will take some time. "We do have executive buy-in. Change is always difficult, so for the business to be totally behind it, we need some quick wins," Tim Speicher of MSA Safety, told us.

There is a clear recognition that the latest advances in AI are real and here to stay. It will become table stakes just like previous technologies, such as e-mail, Wi-Fi, and texting. As Ben Grimes, U.S. Enterprise Commercial Vice President for Manufacturing at **Microsoft** predicts: "Once someone has it, they won't want to give it up." The record-breaking pace of consumer-grade adoption suggests this prediction may prove accurate. Already 27% of American adults say they use AI daily or several times per week, according to **research by Pew**.

AI Investments Focus on Strategic Gains

How do manufacturers prioritize AI implementation initiatives?



Source: Manufacturers Alliance Foundation

75+ Early Use Cases for Advanced AI in Manufacturing

Supply Chain Management	Design & Engineering	Production	Maintenance	Safety	Quality	Info Systems & Cybersecurity	Warehousing & Inventory	Aftermarket / Customer Services
Alternate component optimization	Buyer behavior prediction	Cobots	Anomaly detection	Employee fatigue and distraction	Assembly quality inspection	Attack detection systems	Automated picking	Aftermarket predictive maintenance
Faulty supply tracking	Controller engineering	Energy demand forecasting	Asset health monitoring	Employee PPE compliance	EHS standards library	Attack interruption systems	Autonomous vehicle delivery	Call center knowledge support
Inbound delay forecasting	Design coding assistance	Energy optimization	Contextual predictive maintenance	Potential safety risk prediction	Process parameter optimization	Automated IT operations	Demand forecasting	Connected product diagnostics
Intelligent supplier selection	Design for manufacturability	Machine controller project optimization	Maintenance planning	Real-time monitoring shop floor	Quality prediction	Cybersecurity automation	Dynamic container scheduling	Customer service chatbot
Raw material cost estimation	Design for quality	Material handling optimization	Predictive maintenance	Remote safety inspections	Quality standards library	Data cleansing	Dynamic load matching	Virtual assistance for tech support
Raw material optimization	Design for regulatory compliance	Production line balancing	Root cause analysis	Safety incident analytics	Regulatory compliance inspection	ERP system integration	Dynamic slotting	Warranty claims optimization
Supplier price comparison	Generative machinery design	Production line coding		Safety trend analytics	Visual inspection – cosmetic	Infrastructure performance tracking	Inventory optimization	
Supplier relationship management	Generative product design	Process mining for digital twin setup			Visual inspection – pass/fail	IT service issue prediction	Order processing chatbot	
	Instrumentation data capture	Production planning optimization				Master data management	Predictive stock replenishment	
	R&D efficiency	Robotic process automation				Risk detection optimization	Warehouse automation	
	Verification testing	Spare part inventory				Response automation playbook	Warehouse visibility	
		Virtual expert assistance						

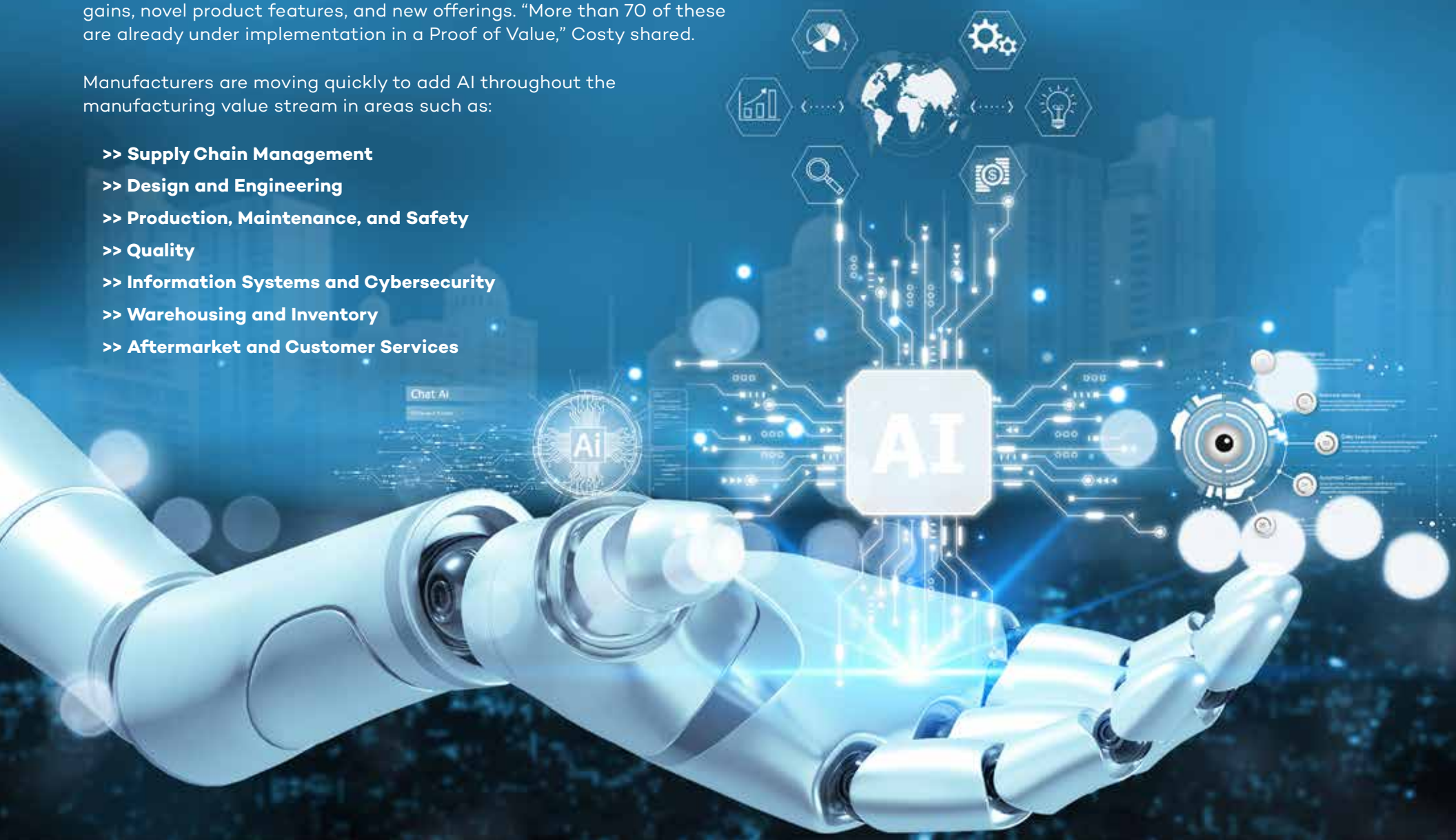
Current AI Use Cases in Manufacturing

There are already hundreds of AI use cases relevant to manufacturing and many of them have passed the proof-of-concept phase to start delivering value. In the past year, **Siemens** has identified 300 generative AI use cases across all manufacturing domains. Del Costy, President and Managing Director, Siemens Digital Industries, US, told us about the company's cross-functional generative AI program which aims to identify efficiency gains, novel product features, and new offerings. "More than 70 of these are already under implementation in a Proof of Value," Costy shared.

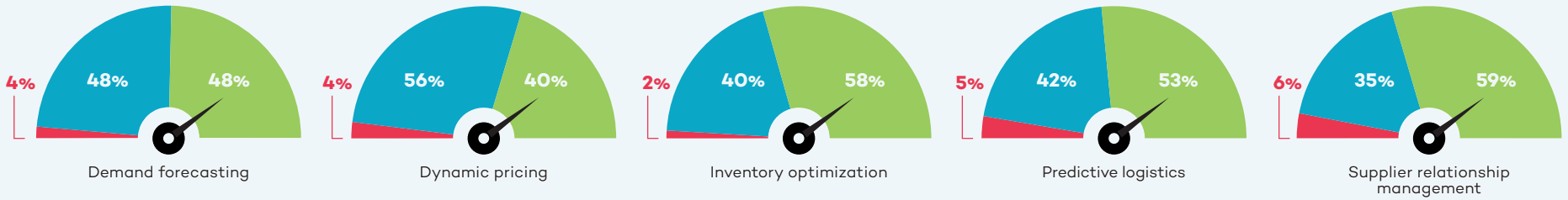
Manufacturers are moving quickly to add AI throughout the manufacturing value stream in areas such as:

- **>> Supply Chain Management**
- **>> Design and Engineering**
- **>> Production, Maintenance, and Safety**
- **>> Quality**
- **>> Information Systems and Cybersecurity**
- **>> Warehousing and Inventory**
- **>> Aftermarket and Customer Services**

This report focuses on seven areas, representing different points along the manufacturing value stream, where AI will grow in importance to manufacturing operations.



Supply Chain Management Use Cases



Source: Manufacturers Alliance Foundation

When it comes to trying new use cases for AI, most manufacturers view the supply chain as a good place to start. AI helps them collect data from across the supply chain in real time. Given the relatively recent disruptions in global supply chains, it is not surprising that supply chain management ranked as the number one functional area for AI initiatives currently among manufacturers we surveyed. "So much of what supply chain management does involves generating content, conversation, validation, and opportunity identification. So, machine learning and generative AI have a ton of opportunity here," Karen Powers of John Deere told us.

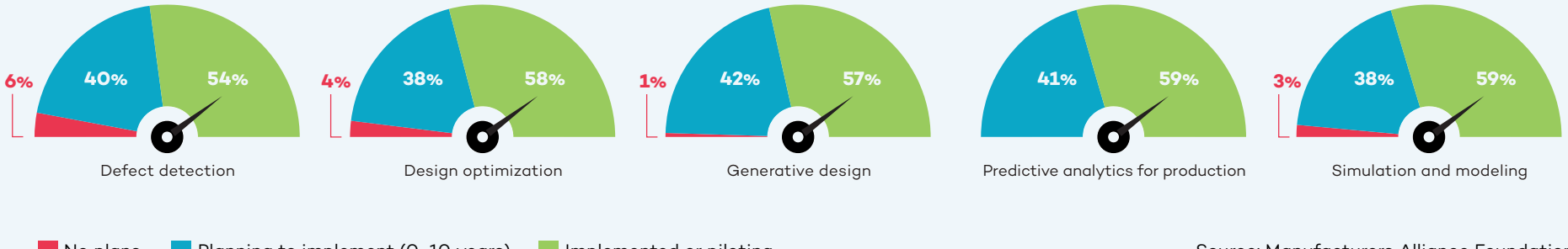
Intelligent supplier selection is already being used to help evaluate a supplier's pricing as well as resiliency based on current market data. Another application is **supplier relationship management**. As Paul Guerrier, Advanced Technology Center Manager at **Moog**, told us, "I can see us using generative AI tools to evaluate incoming information from vendors to check that the vendor data pack is complete, contains good performance measurements, etc." Tim Speicher of MSA Safety envisions AI helping procurement teams "negotiate better contracts and terms with our vendors."

When there is a sudden global shortage of a specific material or subcomponent, AI can be used for **alternate material optimization**. Katrina Redmond, Executive Vice President and Chief Information Officer at **Eaton**, talked about partnering with **Palantir Technologies** to use generative AI for finding alternatives. "All of our information from our ERPs is processed by these large language models. A part shortage or a raw material shortage may be preventing us from completing the manufacture of a product. Do we have alternatives available? By having the descriptions in the system, you can sometimes match on description. If you need an 8-foot rod but only a 10-foot rod is available, we just have to cut 2 feet off to satisfy the requirement for the order." Marc Rosen, Strategic Accounts, Palantir Technologies, added: "Working with Eaton, we created this AI agent that helps cross-reference parts so that if you have a $1 million sale being blocked by $50 worth of raw materials, it helps them find what else they can use in their inventory to complete the order."

AI for **raw material optimization** is helping steel manufacturers determine how to use their own scrap in the most efficient way. "As a steel manufacturer, we always have a mix of scrap material on hand as well as the possibility of what that scrap could turn into. So, we're using AI to help us figure out the probability of producing the product that we want out of this mix. It will help us streamline both the ordering process on the raw material end and the manufacturing process on the melt end," Jared Noble, Director of Digital Technology for **Charter Manufacturing**, told us.

Looking ahead, one manufacturer is hoping that advanced machine learning and AI will help them predict outcomes of a range of end-to-end supply chain decisions to help them land on the right choices based on the metrics they prioritize.

Design and Engineering Use Cases



Source: Manufacturers Alliance Foundation

For design and engineering, the current use cases are designed to speed up the innovation process and reduce time to market through things like AI assistance in **product design**, **innovation design**, **machine design**, and **regulatory compliance**. Michelle Drew Rodriguez, Partner at **Roland Berger**, discusses innovation efficiency in her work consulting manufacturing clients: "We have already identified more than 200 AI use cases for manufacturers, including in supply chain, procurement, operations, human resources, and more. For example, in the product development and engineering space, we have been working extensively with clients on optimizing product design as well as the product development process. We're using AI to review the entire R&D portfolio, then systematically applying AI to advance R&D efficiency throughput and deliverables, including reducing the time to develop commercially viable products. This has enabled us to create efficiencies such as reduction in R&D spend (25%+) as well as greatly improved throughput (up to 60% reduction)."

More than three quarters of manufacturers are starting to use AI for regulatory compliance.

Source: Manufacturers Alliance Foundation

One large manufacturer is using AI to look at **design for manufacturability** of a product to ensure that any errors in design are caught before the manufacturing of a new product or product version begins. Design for manufacturability is especially important in the consumer electronics manufacturing space, where miniaturization must be balanced against the angles and spaces that are required for assembly, especially if that assembly is being handled by a robot.

More than half (57%) of manufacturers are starting to use AI with generative design and another 22% are planning to start in the next two years. Significantly, manufacturers with more than $10 billion in annual revenue are much more likely to be focused on AI for generative design, R&D, and quality than manufacturers in lower revenue ranges.

Southco sees potential future applications of AI during the **advanced product quality planning** (APQP) phase. Deep learning AI algorithms can assist with designing for quality by helping the engineer select the right materials. Shailesh Patel, Director of Quality at Southco, described the situation: "If an engineer tries to design a product in a certain material, AI tells them 'Don't use that material.' This is based on past data. We have had a ton of issues with some specific problem materials, so this is very important for us."

Design for regulatory compliance is another promising application for AI. Southco has started exploring the potential for AI in this area. As Jim Ford, Vice President of Engineering at Southco, explained: "We have to sift through a lot of compliance

> **"We don't have to spend hours writing the code. From a product development perspective, it's huge. We use it every day."**
>
> **– Tom Hewer, Vice President of R&D, Heavy Duty Transportation Group, Marmon Holdings**

paperwork, and it is a very manual process with people parsing that data. So, we want to scrape the relevant information out of everything that is coming in so they can manage the compliance elements." John Deere is also using AI to assist with regulatory compliance by providing AI-driven prompting systems that interrogate the regulatory documents to assist with the interpretation of standards.

Southco is just starting to look at the potential uses for AI in **generative product design**. "A lot of our products are very modular. So, we'd love a customer to come in and say, 'Hey, I like this product, but increase that grip by 10 millimeters.' And if we could do some of that through AI, potential savings and customer responsiveness for us would be pretty significant," Jim Ford of Southco told us.

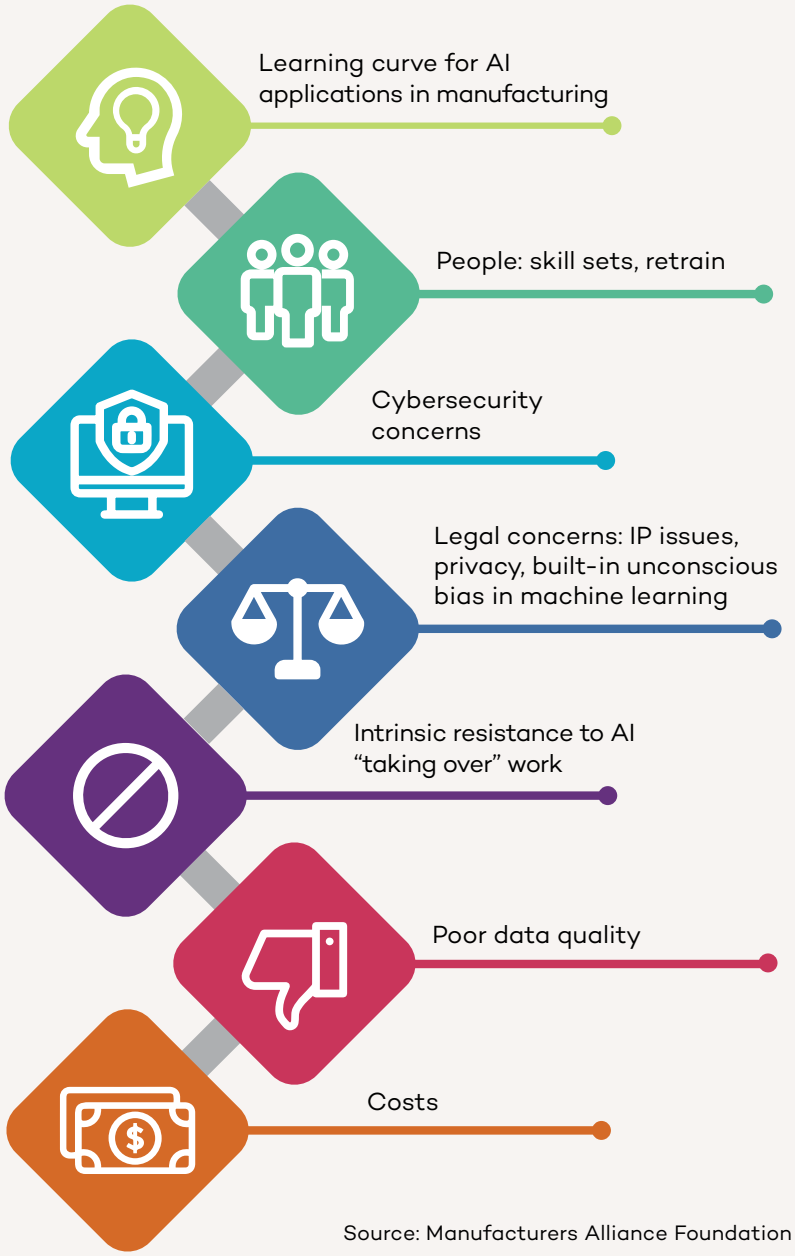
AI in Verification Testing

Verification testing is fertile ground for AI. More and more products have connectivity to other products, machines, or cloud applications, and this requires much more involved testing. The key is to develop efficient testing models. As Tom Salapow, Executive Director, Research & Engineering at MSA Safety, put it: "When you have devices connecting to the cloud and to each other, you have a bigger ecosystem and the instances of things you have to verify goes up exponentially. Instead of doing 10 tests, we now have to do 1,000 tests. So, we're looking at how to develop design of experiments to narrow that down, so instead of doing 1,000 tests, maybe we can we do 100 effective tests and cover everything. I think that's where AI can help us." Salapow pointed to the magnitude and speed of change in this particular area: "It's something we're evolving into now. We have built a team of R&D verification engineers. That wasn't even a role five years ago. That's one of the challenges they're working on now. Any time you make a change, it has a significant effect across everything. You almost have to keep this thing running in real time as things are changing. And that's a natural fit for AI."

Several manufacturers talked about using generative AI for **product development coding**. As Tom Hewer, Vice President of R&D, Heavy Duty Transportation Group at **Marmon Holdings** explained: "One of the places we're using AI is to help our engineers with coding. My mechanical guys are a lot better at software now that they're using AI because they can say, I want a Python script that does this or that, and the AI generates a baseline script immediately that just needs to be adjusted. We don't have to spend hours writing the code. From a product development perspective, it's huge. We use it every day." Ben Grimes of Microsoft has seen more than a 40% increase in code development among its customers using its GitHub Copilot, which helps developers generate code more quickly.

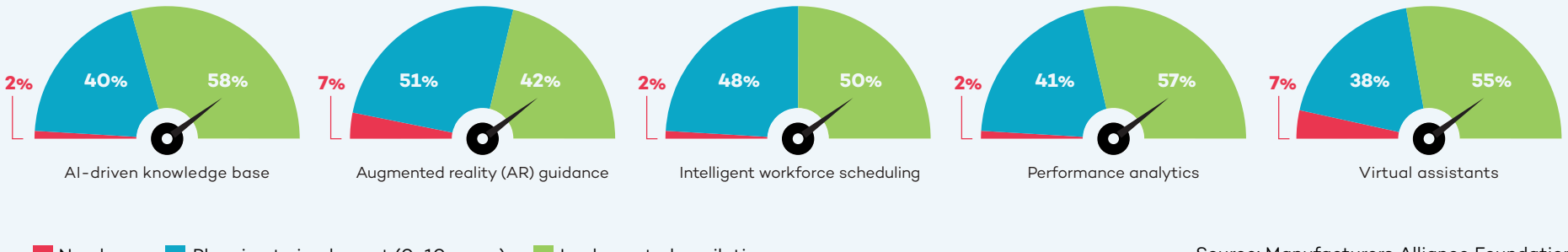
Looking toward the future, manufacturers are also thinking about AI not only for products but for **generative machinery design**. One manufacturer shared: "Can we use AI to help us design not just our products, but also the machines that make our products? Is AI going to come up with things that a human sitting down with a piece of paper is not going to consider, such as transformative, non-standard configurations of parts and machines?"

How Manufacturers Rank 7 Key Obstacles to Adopting AI



Source: Manufacturers Alliance Foundation

Production, Maintenance, and Safety Use Cases



Source: Manufacturers Alliance Foundation

The range of operations in the production and maintenance space opens up a wide variety of new AI use cases. Most manufacturers we spoke with have started using generative AI to provide **virtual expert assistance** to production and maintenance teams. Our survey also revealed that 55% of manufacturers are starting to use virtual expert assistants in this space currently and another 16% are planning to do so within the next two years.

Generative AI also has a role to play by providing detailed instructions for maintenance teams including lists of spare parts and images. This not only speeds up remediation but enables less experienced staff to address maintenance problems.

Clarios feeds a large quantity of engineering documents in different formats (PDF, PowerPoint, Excel) into an in-house generative AI system. Sami Khan, Senior Manager for IT Platform Services at Clarios, told us: "We wanted the AI system to ingest about 1,000 different documents rather than having people searching through hundreds of thousands pages to get an answer. The chatbot spits out a short answer based on the specific question that is asked. We also want this data to be refreshed periodically as people upload more documents so that it is never out-of-date." Khan provided a specific example: "You can ask the system 'what is the procedure for testing paste density?' The system generates a short answer based on the documents that were ingested and links to the source of the answer. If you want to dive in further, you can click on the source."

Krishnan Alampallam, Vice President of IT Applications at Clarios added: "We have the same equipment in multiple different versions all over the world, but we also have a constant churn of people. We never want to depend on an individual brain to deliver these answers because then it becomes tribal knowledge. How do we get rid of tribal knowledge? That's the whole goal behind it."

Coding assistance is another early application area for manufacturers. This is especially relevant for operations employees who have decades of hands-on experience but little training in coding. Siemens and its motion technology customer **Schaeffler** are partnering to use generative AI to help Schaeffler's **automation engineers generate code** for programmable logic controllers more efficiently. This enables engineering teams to generate code faster, with less effort, and with fewer errors. "In the past, we had to speak to machines in their language. With the Siemens Industrial Copilot, we can speak to machines in our language. In a few years, AI will be omnipresent in industry," Siemens Digital Industries global CEO Cedrik Neike predicted.

AI-enabled predictive maintenance is raising the bar on how assets can be protected in an industrial environment. A great example is AI-based **asset health monitoring** for industrial robots. AI can monitor robot health as well as predict failures that might happen before a scheduled maintenance.

BMW is using AI in the assembly process to analyze data generated by its conveyor technology system. Without any additional sensors or hardware, the company transmits data to its own predictive maintenance

cloud platform where algorithms scan for irregularities that could bring production to a standstill, such as changes in power consumption, abnormal conveyor movements, or illegible barcodes. With AI, BMW is able to identify and avoid faults that would have caused 500 minutes of disruption per year at one assembly plant. With one vehicle rolling off the assembly line every 57 seconds, each minute counts. In addition, BMW is able to use the system's findings to continuously refine and improve the algorithms. The vision is for this system to learn to estimate the time between detection of a fault and potential stoppage, aiding operations teams in determining how to prioritize maintenance tasks.

When these types of artificial intelligence and machine learning are combined with generative AI, manufacturers are able to create a **conversational predictive maintenance** user interface facilitating a natural language interaction between the AI platform and maintenance experts. This dialogue streamlines the decision-making process and saves both time and money.

The synergy between AI and human capital is valuable. Del Costy of Siemens stressed the importance of integrating "human expertise and machine learning to extract relevant information from the equipment and process status." By analyzing the process around the equipment, it is possible to detect equipment behavior changes early, enabling better operating and maintenance decisions.

Given the power of AI in this space, it is not surprising that half of manufacturers are starting to use AI for predictive maintenance analytics and another 25% expect to do so within the next two years. **USG** is using AI for "**anomaly detection** of both our assets and our processes," Lou Stocco, Senior Technology Manager at USG told us. "It identifies trends that are less than desirable. It could be an issue with mechanical, electrical, maintenance, or production. We also look at raw material consumption, energy usage, and all of the things associated with the overall manufacturing process. We're calling it condition-based manufacturing," Stocco said.

Advanced Technology Services (ATS) is already looking at what AI will be able to do in terms of **contextual predictive maintenance** as capabilities evolve. Micah Statler, Director of Industrial Technologies at ATS, talked about the next steps: "We're looking to go deeper into the predictive and the condition-based realm and feed our models more contextual data. It's one thing to say the machine is vibrating with this signature. It's a whole different thing to say it's happening under these conditions." Statler's vision is "to drive engineering change without the failure of the equipment to begin with. This prolongs the life of the asset."

In the industrial engineering phase, AI tools can help manufacturers and machine builders optimize their designed operating efficiency, desired throughput, and machine availability by running AI-based optimization tools on the simulated machine controllers (hardware in the loop simulation) in high-frequency. The German company **plus10** provides **machine controller project optimization** software helping companies shorten ramp-up phases significantly by deriving throughput potentials on a controller step-chain level at a very early phase. This reduces later-on mean time to repair (MTTR), production variability, and overall machine ramp-up time of complex production or assembly lines. CEO Felix Georg Mueller told us, "Our software is learning live on machine controllers, either simulated ones during design phase or later on real-ones integrated in the line. By learning behavior models based on high-frequency data streamed in milliseconds, we formalize the behavior, reason the models, and provide counter actions in case of stops, disturbances, short stops, or scrap parts. That generates plus 10% or more output on average, hence our name." When one machine is behaving differently than another in terms of output or frequency of failure, an additional optimizer product can determine the root cause. "We can benchmark machines with each other even if they are thousands of kilometers apart to learn behavior and optimize on the go. In the past, this had to be done manually by engineering, improvement teams, or system integrators," Mueller said.

Manufacturers are also evolving from using AI with individual machines or lines to large-scale **production planning optimization**. Eaton's Katrina Redmond talked about the challenges and the solution. "We have 30,000+ different products. We always need to know how, when, and in what bundles they are selling. AI has given us better clarity across all of our different ERP environments to know which items we are clear to build. For example, it tells us if we have all the product available in the quantities necessary to fill order X, Y, or Z. So, AI is really helping

the planners and the production floor teams figure out which products they can complete before getting to step one of the manufacturing or assembly process. Essentially, AI is telling us, 'Don't bother with this order yet because you're going to be missing a piece at step four.' That allows us to go to the next item where we have all parts and material available."

Material handling optimization is another promising area for AI because it brings together a wide range of data points such as geography, mobility, wireless communication, supply chain, and more. More than half (57%) of manufacturers we surveyed are starting to use AI for material handling and 22% have it on their radar to implement within the next two years. Hyster-Yale is using AI for kitting. John Bartho described what are essentially "shopping cart kitting areas where people are building kits for assemblies which are scheduled to come into production next." The impact is significant in terms of throughput, quality, and cost. "We identify parts shortages earlier and maximize the efficiency of the assembly line. The quality improves because the less you interrupt the process, the higher the quality," Bartho added. This is an entirely new operating model for Hyster-Yale: "Increasingly, our suppliers are either onsite or across the street. This has a financial implication because we're not paying until consumption. The historical model is to buy stuff, put it on the shelf (where it becomes working capital), and then consume it. By using AI for process modeling and relying on more nearby materials, we're more productive and have more working capital efficiency," Bartho said.

Safety plays a role in every function, but it is particularly critical in the production and maintenance domain. AI-based visual systems are already on the market that address everything from **personal protective equipment compliance** to employee fatigue. **Stroma**, for instance, provides edge cameras and industrial edge mini-computers for advanced vision-sensing capabilities to ensure operational staff are wearing the appropriate PPE. Stroma's customers in the energy sector, for example, monitor the use of face shields, gloves, and footwear in real time. "We are tracking safety procedures to ensure they are properly followed in the field. In addition, our system can warn field operators in real time and send those same warning messages to managers," Anil Uzengi, Co-Founder and CEO of Stroma, explained. Stroma's systems can also check for **employee fatigue and distraction**. Uzengi shared an example from a customer in the consumer packaged goods sector: "You can see the worker's attention level is 82%. If it drops below 70%, the system issues a voice alarm to the worker in real time with a customized warning like 'Go grab a coffee!' The worker can respond via the same device to confirm the message was understood. Warnings are captured on a dashboard to measure event trends over time."

One Environmental, Health and Safety (EHS) Director talked about the value of AI-powered **remote safety inspections** in locations where an EHS manager is not physically present on site. "We run extremely lean as a company and we're a smaller manufacturer in terms of operations, so we just don't have the resources to have EHS at every single plant. AI can help us supplement that, for example by identifying a hazard in an aisle, a blocked fire extinguisher, or inappropriate PPE. I think it's fantastic." They also talked about using AI for **safety trend analysis**. "With AI you can discern from the data if you have a location issue, a people management issue, or a supervisor who is not performing."

Mitigating potentially catastrophic safety events is a priority for every manufacturing company. At **The Heico Companies**, Vice President of Environment, Health and Safety Dave Roberts is focused on **safety incident analytics** with respect to potentially severe incident or fatality or PSIFs, a commonly used measurement in the EHS space. "We're trying to prevent catastrophic events from happening, and we're using AI to help us identify the critical precursors that lead to those major events. The whole idea of tracking PSIFs is to avoid getting bogged down by chasing minor events and be in a better position to prevent a significant incident," Roberts said.

Future safety applications based on AI are an important research area for MSA Safety. As Tim Speicher pointed out: "PPE is really the last line of defense. The first line of defense is not to let something bad happen to begin with. And in between there's all this space where we could use more of the data that we collect from our connected devices. We may be able to predict or project bad behavior before it starts. I mean, we're not talking about the movie *Minority Report* here, but we can start to identify problem areas, problem tasks, or even problem people. That's where our opportunities are."

AI as a Training Accelerator

Most of the companies we interviewed are struggling to keep up with training requirements. Generative AI is being used to address training challenges including new employee onboarding, cross-training of existing staff, and bridging the knowledge gap between early and late career employees.

As Joanna Cooper of Daimler Truck North America pointed out, "AI is an awesome tool, especially in light of the changing workforce. There aren't a lot of people that come from a mechanical background, people aren't working on their cars much anymore, and shop classes don't exist in many schools right now, although some schools are starting to offer them again. Being able to use AI to help employees understand more quickly what good looks like as quickly as possible really helps."

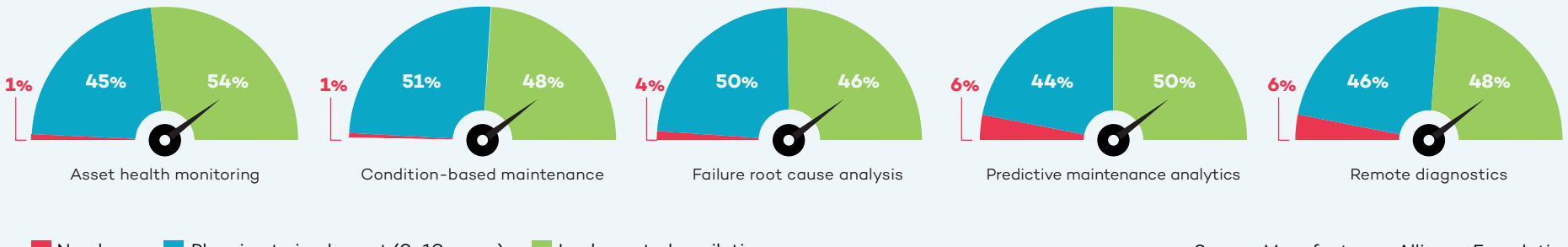
Felix Georg Mueller at plus10 talked about the ability of AI to reduce the reliance on tribal knowledge when production line issues occur:

"Let's say you have an expert who is sitting in front of the line who knows everything by heart. Then you have no problem because he or she can solve the problem in minutes. But those people are quite rare, especially on night and weekend shifts. Employees may not know where to find the root cause or how to address it. There can be a lot of trial and error, and sometimes they make the situation even worse. So our software tells them the root cause related action that needs to be taken and reduces the mean time to repair." As a result, less training is required because plus10's optimization tool proactively provides the missing knowledge, which reduces problem-solving time up to 40% in real-world, multi-shift operations.

A leader who manages training for a product design engineering team in the off-highway vehicle industry described the situation at his company. "More than half of our design engineers have been with the company less than five years. Three to four of those years have been spent working from home. So, we're looking at ways to help these new engineers find the information they need to be successful. In our engineering knowledge world, AI can go out and scour whatever we connect it to and bring that information back. The idea is to teach these R&D engineers how to do their jobs based on our standard processes and tools, but without having to go through years' worth of development with somebody sitting right next to them."

In addition to AI-based training, manufacturers are also deploying "train the trainer" campaigns to spread AI knowledge throughout their organizations. Jared Noble at Charter Manufacturing told us about training "30 AI subject matter experts inside functional areas across the company's business units." Those people are helping to identify valid use cases for AI including the value it can deliver and the shape of a deployment. "The goal is for these people to have a good understanding of the basics of the tool sets as they're seeing problems in their space. For us in the data science group, it means we're getting more valuable information about how to approach use cases. We want to avoid having a divide between the technologists and the people in the function," Noble stressed.

Quality Use Cases



Source: Manufacturers Alliance Foundation

AI is adding significantly to the technology mix supporting quality. The advances in computer vision over the past decade have already made computers superior to humans in their ability to catch things that are not visible to the human eye. Now, with generative AI, analysis of images can help reduce false positives (good products that fail inspection) as well as false negatives (bad products that pass inspection) thus increasing throughput and quality. More than half (55%) of manufacturers are starting to use AI for defect detection systems in production. Another 20% plan to within the next two years.

More than half of manufacturers are starting to use AI for defect detection systems. Another 20% plan to within the next two years.

Source: Manufacturers Alliance Foundation

Daimler Truck North America is using AI to ensure **vehicle assembly quality**. "Engineering designs are becoming more complex, so AI enables us to ensure proper torque, orientation, and seating when parts of the truck are being joined," according to Joanna Cooper of Daimler truck. All of these things need to come together in a timely manner on the line, so it is important that operators understand the desired result. "We've taken one of our more complex joints that has the layers of all the things that need to happen correctly to show operators what good looks like. We started with the vision system, and now we're using machine learning to capture various failure modes to make the vision system even more robust. The idea is to capture those defects as quickly as possible," Cooper continued.

Chatbots play an important role in quality management as well. "I'm frankly stunned at how good the chatbot technology is. We

John Bartho of Hyster-Yale talked about using AI for **visual inspection and analysis**: "I recently visited our factory in Mexico where we make all of our frames. You might think this wouldn't be the most automated place, and historically it hasn't been. There are about 300 employees, 210 of them are welders. But what I saw there surprised me. There are robots doing welding because they can do a seam without interruption thus delivering a higher quality weld. In the quality area, they are using vision systems to do random inspections of frames. The vision system compares the manufactured frame to the CAD drawing and highlights anything which might be variant. This is incredibly helpful because problems are often not visible to the human eye or difficult for the non-trained person to see. As we do more of this, we can improve quality overall by identifying these issues earlier." As this example makes clear, the AI-assisted visual inspection and analysis is addressing not only quality but also a training bottleneck, an issue encountered by many of the companies we interviewed.

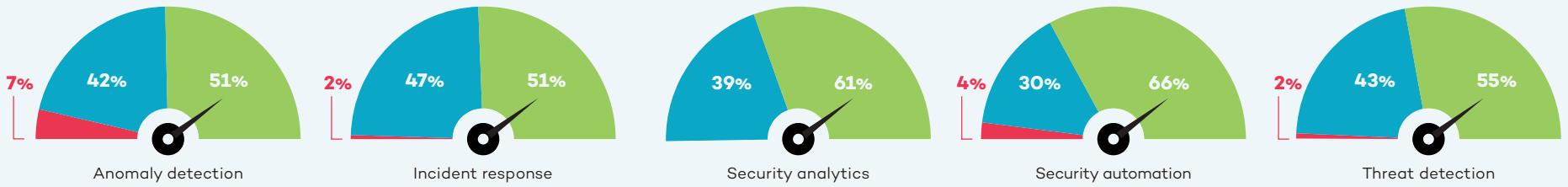
put all of our **quality and EHS standards** and processes into the AI system over a period of a couple of weeks. Now we have an open library of easily accessible information," Martin Smith, Vice President of Quality and EHS at **Danfoss Power Solutions** told us. He also shared: "People are falling off their chairs at how simple it is to find answers. We tested it in a live meeting by throwing questions at it. It just came straight out with the correct answer. There was silence in the room. This saves literally hours of searching and sometimes only finding irrelevant documents."

Computer vision for **quality prediction** is another valuable AI use case. Anil Uzengi of Stroma discussed his company's work for a major tire manufacturer: "We are analyzing rubber sheets and detecting defects in real time. Our advanced vision capabilities use industrial edge cameras, and AI predicts anomalous areas. This triggers a warning to an operator or manager about the need to shut down the machinery." Uzengi highlighted the incremental but significant ROI impact delivered by AI in this application: "This company already enjoys 96% to 98% accuracy in their defect detection process, so we are just adding another 0.5% to 2% into this 96% to 98% accuracy. The incremental improvement in quality provided by AI may sound small, but for a large company like this, it means millions of dollars per year."

AI can also take the subjectivity out of some visual inspection ratings, such as **cosmetic inspections**. For example, a specification for a bright zinc coating can be tricky without AI because humans may disagree about the definition of bright. Similarly, pass/fail cosmetic inspections of machine components can also be a matter of interpretation. Paul Guerrier of Moog shared: "In aerospace many parts are anodized, and pass/fail inspections look at things like dents and scratches." It is virtually impossible to prevent them completely, but they can be minimized. Guerrier talked about potentially using AI "to define the exact criteria (size of flaws, for example), for pass/fail decisions. I think you can actually define that within the vision system."

Moog started using AI for quality to increase throughput and to address cross-training requirements for its operators. Paul Guerrier described layering computer vision and deep learning into traditional visual inspection practices: "I would describe it as **AI-enabled inspection**. Our operators have traditionally checked things through a microscope. We added a camera as well as a computer to do the deep learning. We then created the hardware data set and the training images which were used to train the AI. Now the operator can either look down the microscope or they can look at the flat screen, which is displaying the image from the microscope in pretty much real time. If they look at the flat screen, the AI gives them pass/fail advice while they're inspecting. The human is still totally in charge." As Guerrier described it, this example of using AI is his "Goldilocks scenario" because it is an augmentation, not a replacement. "If the AI stopped working or started misbehaving, the operator still has control and we can always revert to manual," Guerrier said. Moog has seen a significant productivity improvement because of this change. In addition, ergonomic safety is enhanced because employees can spend less time bending to look through a microscope.

Information Systems and Cybersecurity Use Cases



Source: Manufacturers Alliance Foundation

Digitalization is increasingly turning manufacturing companies into data-driven enterprises. Security and data quality are paramount and growing more challenging as manufacturers add more sensors, edge devices, autonomous vehicles, and other connected equipment to the factory floor. AI can help manufacturers address this complexity as well as monetize their data.

The key first task for most of the companies we interviewed is addressing the widespread problem of data integrity. **Data cleansing** is job one because data must be accurate, complete, and in context to be useful. As John Bartho of Hyster-Yale put it: "We have a lot of data, but when we first put it all together in the same pot, the stew didn't taste good. Now we have a centralized group for master data management. We started with all the data around the customer, and we're expanding that."

Vitaulic's Director of AI, Bob Straight, talked about aligning programs to fit an organization's data strategy maturity: "I work closely with our data team to make sure that I'm not overcommitting us if the data isn't ready." AI is helping companies address their data quality and data strategy weaknesses. AI-driven **master data management** can automate the monumental tasks of profiling, cleansing, and standardization.

> **"We are only scratching the surface in what generative AI will mean to security operations."**
>
> **– Kevin Faulkner, Director of Product Marketing, Fortinet**

This is a critical step because the data will be used to train the AI model. If data is inaccurate or mislabeled, the output will suffer. One manufacturer shared, "We created something like a **customer service chatbot** tool that uses AI to generate answers. Basically, the whole system worked great, but a lot of the answers were wrong because our source data wasn't in the right place, was inaccurate, or wasn't up to date. The weak link in our tool was the data that it was pulling from."

Many companies have grown through acquisition and need to make disparate information systems work together seamlessly. Katrina Redmond shared Eaton's application of AI to address **ERP system integration**: "We have so many feeder plants with different systems, and the information doesn't clearly flow together. But with AI you can load all the individual ERPs into a system and then cross-reference everything more simply."

Getting systems to connect while securing them against cyberattack is essential. Two-thirds of manufacturers are using AI-based **cybersecurity automation** to proactively defend against attacks before there is a breach.

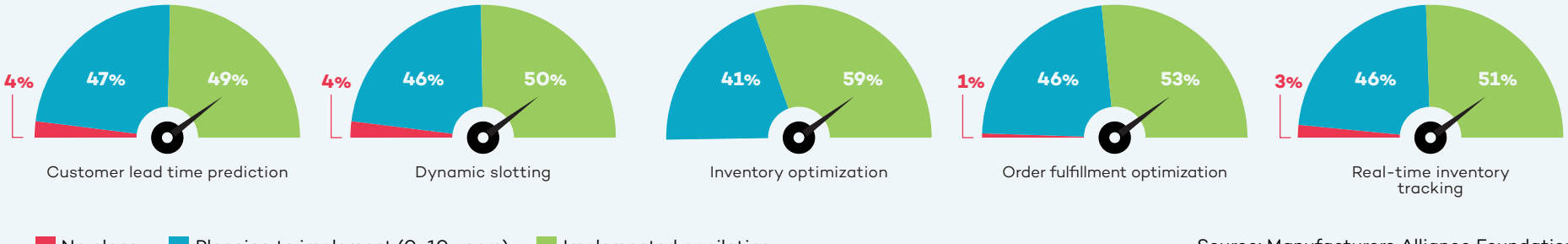
AI and machine learning are well-entrenched in this space and have been "for more than a decade in the form of processing billions if not trillions of data points every day," Richard Springer, Director of Marketing for OT Solutions at **Fortinet**, told us. "The conversation around generative AI is relatively new, but that's the future. It's not going to replace humans in this space, but rather make them more powerful and efficient."

Fortinet has been adding generative AI assistants to its products since late 2023. Kevin Faulkner, Director of Product Marketing at Fortinet, explained, "this is not about opening a second browser window for Chat GPT and asking questions. This is actually embedded within our products. It is context relevant and context aware, including very specific OT knowledge." In the case of an **intrusion detection**, an employee would typically perform **threat analysis** including determining how dangerous it is, what it typically does, and what techniques can be employed to investigate the intrusion. "With our solutions, employees can use either a written or verbal interface to get answers to these questions. This makes people better at their jobs by allowing entry-level analysts to get more work done at a more senior level because they have an assistant looking over their shoulder," Faulkner continued.

Large language model integration also makes it possible to generate recommendations on how to prepare and respond. As Rod Locke, Director of Product Management at Fortinet, told us, "You can actually build **automation playbooks** based on best practices for a given scenario, including processing certain types of events in an automated way in the future." The result is effectively upskilling employees in terms of their effectiveness to the organization.

Time is critical to security. When bad actors find out about vulnerabilities, they target them very quickly. "There used to be about an eight or nine day time period to prepare after a vulnerability was released. Now, that has been shortened to about four or five days," Richard Springer told us. "It can be a very manual process to separate the wheat from the chaff and find out what's actually going on. With generative AI tools, we're making employees faster and elevating them to a higher-level response allowing us to shrink the time it takes to get in front of bad actors."

Warehousing and Inventory Use Cases



Source: Manufacturers Alliance Foundation

Advanced AI is enabling manufacturers to solve a number of warehousing, inventory, and logistics challenges in ways that were previously impossible. **Warehouse management automation** systems are changing the way inventory is tracked, picked, and replenished.

A great example is **inventory optimization**. More than half (59%) of manufacturers are starting to use AI for inventory optimization and another 26% plan to within the next two years. When a manufacturer announces a coming price increase, the result can be a spike in orders followed quickly by a backlog. To avoid this situation, manufacturers are using AI to prevent this type of avoidable inventory volatility. Bob Straight of Vitaulic told us that inventory forecasting is a focus area for his team: "Addressing inventory forecasting challenges represents a significant win for Victaulic because it benefits not only operations and supply chain, but also sales and customer care."

USG considers inventory management a strategic component of its value proposition as a company. **Dynamic slotting** plays a key role. As Lou Stocco explained it: "We are a make-to-stock manufacturer, so our guiding strategy is to be the lowest landed cost producer in all of our product spaces as well as the easiest to do business with. We are using AI to better align the amount we produce with the limited space in our warehouses. The idea is to get as much product to as many customers as possible

"We are transitioning these people from non-value-added work to value-added work which allows them to focus on parts of the operation that really need it."

– Lou Stocco, Senior Technology Manager, USG

while giving them excellent service. For some of our customers, we guarantee next-day delivery. That level of service requires careful orchestration of a lot of product on the shop floor." The big picture for USG is to have employees engaged in more valuable activity instead of extracting data, creating dashboards, or doing analysis. Stocco explained: "We are transitioning these people from non-value-added work to value-added work which allows them to focus on parts of the operation that really need it."

When it comes to logistics, AI is playing new roles as well. John Deere, for example, is looking at AI solutions to become more efficient with its delivery trucks. Using generative AI for **dynamic load matching** may be the answer. As Wallas Wiggins of John Deere explained, "We would like to have a truck out there to deliver and pick up multiple times before it circles back home. I see that as one of the next big fronts for us because we spend a lot of money on logistics. We also have sustainability goals. I want to make sure every time a truck rolls, it's meaningful rolling, not empty rolling."

Process mining is playing a key role here. The German software company **Celonis** has developed process mining software that creates a digital twin of a company's processes by capturing data from every split second of a process and turning it into a digital twin. Their work with **Mars** on dynamic load matching has achieved significant results. Mars has been **able to combine truck loads**, cut shipping costs, and speed up delivery resulting in an 80% reduction in manual touches as well as lower costs and reduced emissions.

Aftermarket and Customer Services Use Cases

Many manufacturers are exploring how to build deeper relationships with customers through service excellence and as-a-service offerings. AI can play an important role by giving manufacturers insights through **connected product diagnostics** and **always-on self-service assistants**. These tools give manufacturers actionable data about their products (how they are performing, how customers are using them) that can be plowed back into R&D and product development.

Traditional technical support is getting faster and better through **virtual expert assistants**. Siemens has deployed technical service chatbots that are able to understand questions and simulate human conversation. Katrina Redmond of Eaton talked about the challenge of technical support for products that are 40 or 50 years old and still in use. "We're using AI to quickly ingest all of these manuals and decades worth of information so the tech team has it at their fingertips. Because of AI, a technical support person can answer a phone call from a customer and immediately respond with the best answer for their particular issue. Turnaround times can be dramatically reduced."

One heavy equipment manufacturer is using AI for **warranty claims**. An executive there shared: "There's a lot of free-form text in the warranty claims, several hundred words in each claim. Individuals used to spend an enormous amount of time reviewing these claims. Now we have deployed a large language model that simplifies the claim information. We have just rolled this out, but it has the potential to save hundreds if not thousands of hours of people's time looking through warranty claims per year."

Danfoss is testing AI to omni-channel customer feedback arriving via email, call centers, and customer portals. "In the past, addressing customer feedback meant manually searching for product number, serial number, manufacturing site, point of sale, etc. I thought deploying AI to handle this would be hard, but it was remarkably easy. We have the same amount of information as we had before and didn't lose anything," according to Martin Smith at Danfoss Power Solutions. This allows employees in these roles to be re-deployed into value-adding parts of the organization.

Aftermarket predictive maintenance is another promising area for manufacturers. New entrants such as Tesla and Rivian are offering the ability to predict when a part might fail based on data they capture from the vehicle itself. This information can be enriched based on actual miles driven, vibrations, geography, climate, road conditions, and driver behavior. By correcting problems earlier, customers will likely save on repair costs and automotive companies will encounter fewer warranty claims.

Astec Industries is putting more and more intelligence into its products along what it calls the rock-to-road value chain. Eric Baker, Vice President of Astec Digital, talked about the importance of speeding innovation and making its products smarter "because customers are demanding it." One example is inspection of asphalt silos being used by customers involved in building or maintaining roads. "There is a lot of weight in those silos, and the material is abrasive. Silos need to be inspected to ensure that they maintain their structural integrity," Baker said. With a robot or drone remote control device, Astec's customers are able to visually inspect silos and process the information using AI. "Previously, analyzing that information had been a manual process, but with machine learning and AI, we are able to identify thin spots or worn-out welds to determine if a silo is structurally sound." Baker talked about the growing importance of digital twins for this traditionally low-tech space. "We are investing heavily in augmented reality so that it is possible to see one piece of a plant that exists in the physical world and add other pieces in the digital space, allowing customers to visualize how things fit together," Baker said.

Caterpillar is using aftermarket predictive maintenance to connect dealers with customers' equipment. Its AI systems are analyzing **data from more than 20 different sources**, such as equipment sensors or fluid analyzers, to create an accurate picture of the performance and health of the customer's asset. This allows a Caterpillar dealer to monitor the equipment, detect possible issues, and alert the customer to take action before a failure occurs. The dealer can then recommend the parts and services needed to keep the equipment running.

Getting Started and Creating an AI Roadmap

A Conversation with Michelle Drew Rodriguez, Partner, Roland Berger

Q **Manufacturers want to know how to deploy AI as quickly as possible. What do you recommend when you consult with manufacturing clients eager to get started?**

A First, we try to make the process as easy and pragmatic as possible – "less hype, more results" is our motto when it comes to implementing AI with manufacturers. We take them through a systematic framework for developing an AI roadmap, and partner with them to 1) assess their current state, 2) define their future state, and 3) create a detailed execution plan. (See roadmap, page 28.) At kickoff, we ask key questions including: What is the current state of their strategy, value proposition, and technological maturity? How are the people, processes, and culture working together in the organization now, and what does its wider ecosystem look like? We ask that companies be brutally honest in their answers; it is the only way to make progress. At this point, we often hear about problems with legacy systems, data silos, and poor data quality in general. This is very typical of many manufacturing organizations right now.

The current state assessment is a great way to get everyone on the same page and using the same vocabulary, which is an important first step. We see barriers to adoption for the simple reason that people may not have a clear understanding of what AI is, or what it can do for them. There's so much hype around AI right now, and to many people it just seems big and nebulous. At the same time, we encourage companies to start small and find success quickly. What we mean is, once you've identified a few easy, low-hanging use cases within the organization, execute pilot projects to gain momentum. Quick success and real proof points help make AI tangible for employees. This is the quickest way to demystify AI and spark interest among people who don't have much knowledge or belief in it. Demystifying AI and building a strong, unified quest for change needs to happen early on. This allows companies to build leadership resolve on a strong foundation, including a commitment to invest and drive accountability through the businesses for the changes ahead.

Q **The current state exercise sounds important but also arduous. Do you find that companies want to stop here and clean up the existing problems, or do they want to plow ahead with AI?**

A From our experience, it's a mix of both. Companies are finding that AI isn't so much a new challenge but more of a solution to many of the problems they have identified in their current state analysis. Take the siloed data problem. AI can help manufacturers share data from disparate systems across multiple entities to make more sense of, for example, supply and demand trends. They get better at fulfilling customer needs and optimizing inventory instead of guessing or simply creating more buffer.

When companies start to envision their future state with AI playing a role, they also develop a clearer AI vision aligned with broader business goals. For example, they are not just brainstorming where they can add AI because it is technically possible; rather, they are prioritizing use cases based on business impact. This makes it easier, at this point in the process, for manufacturers to derive technical requirements and blueprints as well as needed organizational and governance structures.

The final step is execution planning. This is where manufacturers have an overall actionable plan as well as methods and KPIs to track the value that AI is delivering. They are making further refinements in terms of technology, people, processes, and culture, and are also documenting early wins and weaving any lessons learned back into the overall plan. Once they start gaining traction, companies can take a hub and spoke approach to saturate the businesses and functions with the knowledge and success already

gained. We find that creating and celebrating the early, quick wins really helps the broader organization's receptivity to implementing additional AI measures.

Q **Based on your experience with manufacturers so far, how fast will AI spread in manufacturing?**

A Nobody has a crystal ball, but I think it will be very similar to other technological transformations and will evolve at a much faster, exponential pace given the VUCA (Volatile, Uncertain, Complex, Ambiguous) times manufacturers live in now. Simply put, the fundamental need for real-time decision making is greater than ever before, and the stakes perhaps higher than ever. Therefore, I believe the typical barriers to adoption are lower for AI than prior technology adoptions. Use cases that make sense now will continue to make sense, but the solutions keep getting better and more all-encompassing. For example, use cases today are often aimed at solving one problem, but as AI maturity advances, manufacturers will be increasingly using platform-based solutions. They'll address multiple use cases at once rather than singular pain points. The impact will be enormous not only in terms of competitiveness of individual companies but also in the ability of manufacturing as a whole to take on megatrends such as resiliency, resource scarcity, and climate change. Manufacturers I speak with care about these issues and view digitalization and AI as key to addressing these grand challenges.

AI Roadmap for Manufacturers

	Current State Assessment	Future State Identification	Execution Planning
Strategy & Value Proposition >> AI vision & aspirations >> AI strategy setting >> AI value mapping	Secure **leadership support & commitment** Evaluate **underlying aspirations** from AI **integration** Understand business **needs & expectations** **Gauge** investment **commitment** to **drive AI initiatives**	Define and communicate clear **AI vision & strategy** aligning with **broader business goals** Establish **evaluation and prioritization** metrics for AI use cases, including applicability and business impact Assess **ROI** of AI initiatives	Formulate **overarching actionable plan** for AI integration (PoC, prioritized waves, etc.) Maintain, evaluate & prioritize the **living document** of **AI use cases** Develop **methods & KPIs** to track value delivered
Tech & Execution >> Technical blueprint >> Data foundation >> Compute & tech infrastructure >> AI development & operationalization	Conduct **readiness assessment** of existing AI technology & processes > Technical blueprint re: **architectures** > **Data** availability, quality & governance > **Infrastructure** & security > **AI tools & processes**	Define **target technical blueprint** based on clear **guiding principles** Identify **potential deficiencies/ gaps** as well as necessary tech partner(s) Establish **data assets** required for AI tools Design **target infrastructure** & forecast **compute demand** with aimed security level	Develop a **roadmap** to address the deficiencies within the technical blueprint Establish **data acquisition** processes Determine protocols to **address data security & compliance risks** Design a **scalable infrastructure strategy** to support future growth
People, Processes & Culture >> Operating model >> Governance & policies >> Human capital >> Partnership & sourcing model	Review as-is **operating model** Identify **roles dependencies** Examine **present governance & policies** Measure **workforce capabilities and skills** Evaluate established **partnerships**	Develop **target operating model**, including business process, roles, etc. Design **AI governance structures** Determine **new skills** due to AI integration Establish **prioritization criteria** for potential partnership	Establish tracking **KPIs and milestones** Integrate guidelines and principles into **AI deployment** strategy Design **talent attraction & upskilling programs** Activate **prioritized partnership** for implementation

Source: Roland Berger

Conclusion

As our interviews made clear, the race to bring more AI into manufacturing is on. It is not a question of if manufacturers will lean more heavily on AI throughout their value stream but how much and how quickly. The already large number of AI use cases is expanding every day as manufacturers open the aperture on how to think about the power of AI throughout the value chain. Likewise, as AI evolves from individual use cases to bundles of use cases that address sets of requirements, the power of AI will expand even more rapidly.

While there is a learning curve for every company, most organizations discover early on that AI helps them solve existing problems (such as training bottlenecks and supply chain issues) more efficiently while increasing safety, productivity, and quality in their operations.

At first glance, AI may seem like another major transformation to address within organizations that are already struggling with digitalization. But **many of the foundational steps required for successful digital transformation are also required to deploy advanced AI**. A mature data strategy leveraging accurate data will be the first major step for many companies and is a precondition for both digitalization and AI. Relatedly, many manufacturers find they need to take a hard look at their existing processes early on so that they avoid the trap of simply replicating a bad set of processes in the digital realm. Connectivity is also paramount. Artificial intelligence, like digitalization, requires that machines and systems talk to each other in real time to provide full transparency into operations.

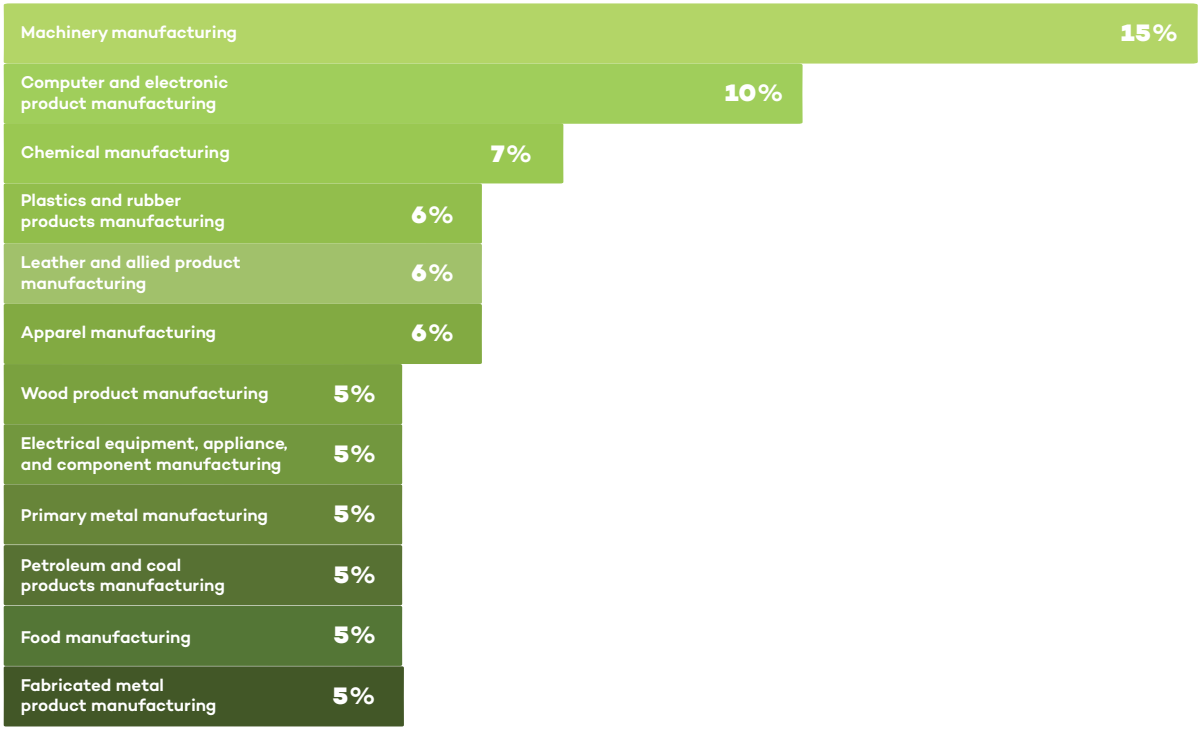
As with any technological transformation, the role of human acceptance is critical. Every company we spoke with stressed that AI represents a means to make their employees more productive and offer them more fulfilling tasks. It is critical for leaders to recognize the opportunities that AI brings and communicate these opportunities to employees. “Part of the leader’s role is to drive a confidence level into the team and say, ‘this can happen, it will happen, and there will be a culture change,’” Martin Smith of Danfoss Power Solutions stressed.

As Joanna Cooper of Daimler Truck North America put it, “it’s all about upskilling people to add value in a much different way. It’s a fallacy to say that AI won’t eliminate some jobs. It will. But it won’t necessarily eliminate the person’s ability to add value to the organization, and those are two very different things.” It is incumbent upon every executive to stress this point to employees. “It’s important for leaders to communicate the role of AI so that people understand it will impact their world, make their world better, and shift what they will be able to do,” Cooper added.

About the Research

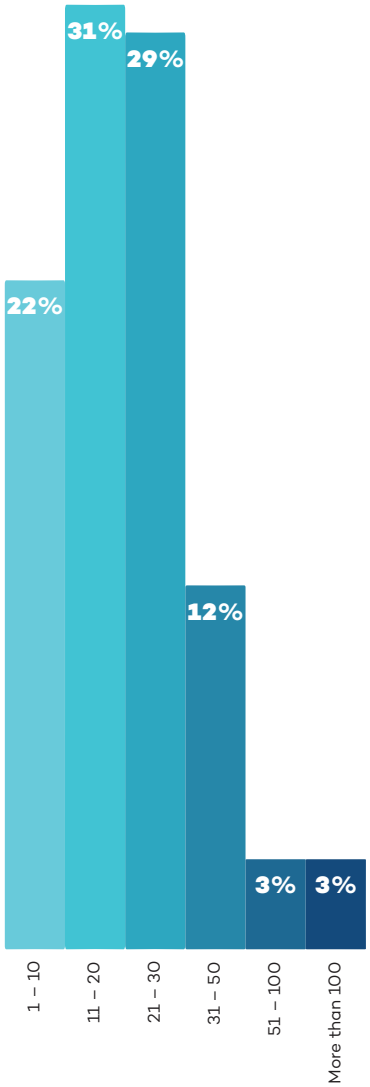
Manufacturers Alliance surveyed more than 200 leaders in manufacturing to better understand the state of AI in manufacturing currently and in the near future. We have highlighted some statistics about the respondents.

Top Primary Industries

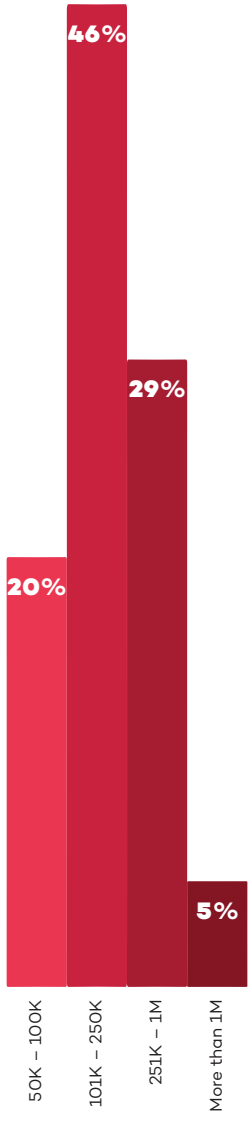


Annual Company Revenue

Number of Factories



Average Factory Size (in Square Footage)



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