AI in operations:

Revolutionising the manufacturing industry

Introduction

PwC has been tracking the impact of a number of megatrends for well over a decade. These forces, which include climate change, technological disruption, demographic shifts, a fracturing world, and social instability, are driving significant change for both business and society and have major repercussions for manufacturing industries.

For example, a 'green transition' to achieve lower carbon emissions is shaping both the production of manufactured goods and underlying supply chains. Worries around a fracturing world and social instability are impacting global production footprints and raising concerns over supply chain resiliency, while demographic shifts are creating issues with workforce availability. Increased costs due to inflation and rising energy prices are also creating additional pressure on manufacturers.

Business leaders in manufacturing companies must consider all of these developments and should be able to respond to them. That includes making tough decisions on how they should invest scarce resources.

Technology can help companies address these challenges. In some industries, it is already enabling new business models. Traditional forms of artificial intelligence (AI) have transformed logistics, for example, helping make omni-channel retail possible by enabling efficient and trackable package delivery. The advent of generative artificial intelligence (GenAI) is currently bringing a new wave of disruption. Software code is now being written by GenAI assistants, customer service is being delivered by chatbots, and media content is being created by GenAI models, helping the humans overseeing these activities work faster and more efficiently. The newest frontier is 'agentic' AI, where agents autonomously execute tasks like ordering spare parts or adjusting a production shift plan.

While widespread changes to business models are not yet immediately apparent for most manufacturing industries, the potential for both traditional and newer types of AI to reshape the competitive landscape is immense. AI tools are enabling profound changes to research and development (R&D), procurement, supply chain and production processes, which promise to significantly enhance value chains going forward.

This study examines how more than 400 manufacturing companies from 31 countries across Europe, the Middle East, and Africa – operating in a range of sectors as detailed in the Methodology section – are adopting AI and GenAI to enhance their core Operations functions. It provides insights into what benefits executives expect and what's been achieved so far. The report also highlights how much these businesses are investing and the challenges they face. The research also reveals some key success factors from companies that are further ahead on their AI journey.

The final section of this report details clear recommendations for how companies can make the most of AI in operations and achieve real benefits for their business as well as long-lasting, sustainable change.

Executive summary

The manufacturing industry is undergoing significant transformation due to a variety of factors, including a 'green transition' that is impacting both products and the supply chain, changes in global production footprints and concerns over supply chain resiliency, increasing digitalisation, tightening regulation, and issues with workforce availability. Increased costs due to inflation and rising energy prices are also creating additional pressure on manufacturing. AI, including traditional forms such as machine learning and newer developments like generative and agentic AI, is playing a crucial role in addressing these challenges. It is making it possible to revolutionise procurement, production, R&D, and supply chain processes, thereby reshaping the competitive landscape and enhancing value chains.

A research study of over 400 operations executives from 30+ countries in Europe, Middle East and Africa was conducted to track their expectations, progress, and learnings from applying AI in operations. Respondents came from a broad range of manufacturing sectors, as well as the transport and logistics and retail sectors. The results clearly show that manufacturing companies believe strongly in AI's potential to increase profitability. Nearly 70% expect it to increase operating profits by at least three percentage points by 2030. And more than 40% anticipate an even greater rise of five percentage points in operating profits.

But while manufacturers are beginning to see positive impacts from initiatives to date, just 4% report that they have already achieved significant financial benefits and return on investment (ROI) from AI in operations. That reflects a relatively low level of AI maturity. Less than a third of respondents say their companies have moved beyond the research or initial pilot stage to scaling AI across multiple departments, and only around 8% are true 'AI Operations Champions' who are already systematically implementing AI across the enterprise and optimising and expanding its use.

Getting to the next level will require investment and results here were mixed, with some companies planning significant investment levels, while others are not yet ready to commit.

The results of the study indicate that the potential benefits will likely justify the effort. AI is positively impacting businesses by improving decision-making, enhancing operational productivity and flexibility, reducing costs in areas like energy and personnel, and increasing sales and delivery volumes. It is also helping fill some of the skills gaps emerging in the industry. AI Operations Champions are reaping the most benefits as they scale and integrate AI across their operations.

Manufacturers are already exploring diverse use cases across all the core operations areas, but there are significant differences by industry. Automotive companies are the most mature, especially when using AI in production use cases. Industrial products companies are also advanced in production and supply chain use cases. Pharma, life sciences and med tech companies are leveraging the full spectrum of AI use cases, including for R&D and procurement. Transport and logistics companies lead on supply chain applications, while the aerospace and defence and retail and consumer sectors show lower adoption rates.

Getting a handle on data is seen as the biggest hurdle to AI adoption. Data availability, quality and security were all among the challenges most often reported by respondents. Other top concerns included keeping up with the speed of change and developing AI expertise.

Four principles to accelerate your company's AI in operations journey

Define a clear AI strategy for operations that is aligned with your overall business goals and technology strategy and sponsored by leadership

The first step to making the most of AI is to clearly define and articulate a compelling vision for how you intend to use AI across your Operations functions. To do this, you will need a strong understanding of external factors that are impacting transformation in your industry. Your strategy should define a clear 'way to play' that articulates how AI can build on your organisation's strengths and support opportunities for future growth and efficiency. It's also vital to get strong support from the CEO and broader business leadership. AI strategy is not just about technology, it can potentially impact your entire business.

Focus on use cases that deliver short-term ROI while keeping the bigger picture in mind

Companies should take a holistic approach and develop complementary use cases, rather than treating each project as a one-off. Every use case should support the specific capabilities and business goals as set out in the company vision and strategy. Keeping the focus on projects that will deliver strong returns, rather than deploying technology for its own sake, is critical. Using out-of-the-box features and taking advantage of GenAI as a launch-pad can help to keep costs under control and quickly achieve ROI.

Build a strong technology and data foundation for AI

Companies should focus on building an integrated data and AI tech stack. This will establish the strong foundation needed to scale a comprehensive portfolio of AI use cases across the entire organisation. Building siloed solutions for each use case limits component re-uses and will result in higher total cost of ownership in the long run. Strong partnerships with technology and service providers can help.

Emphasise strong organisational structures and robust AI governance

Strong organisational structures and processes are essential. Companies should establish a central AI function to effectively steer and deliver their AI strategy roadmap; a hybrid, 'hub-and-spoke' model that balances top-down guidance with bottom-up ideation and implementation is the most effective for many companies.

Building trust in AI is equally critical. Responsible AI practices emphasise trust by design, which means embedding best practices throughout AI development and deployment processes.

AI is transforming manufacturing industries. The question is no longer if or how it will impact operations, but rather how fast. PwC's 28th Annual Global CEO Survey: Reinvention on the edge of tomorrow shows that chief executives understand that.

Operations leaders need to catch up quickly and make bold decisions too. They cannot afford to wait to see how AI evolves before setting out their AI strategy and committing to AI investments, or they risk losing ground to more ambitious competitors.

The time to revolutionise your manufacturing business is now!

Opportunities and expectations of AI in Operations

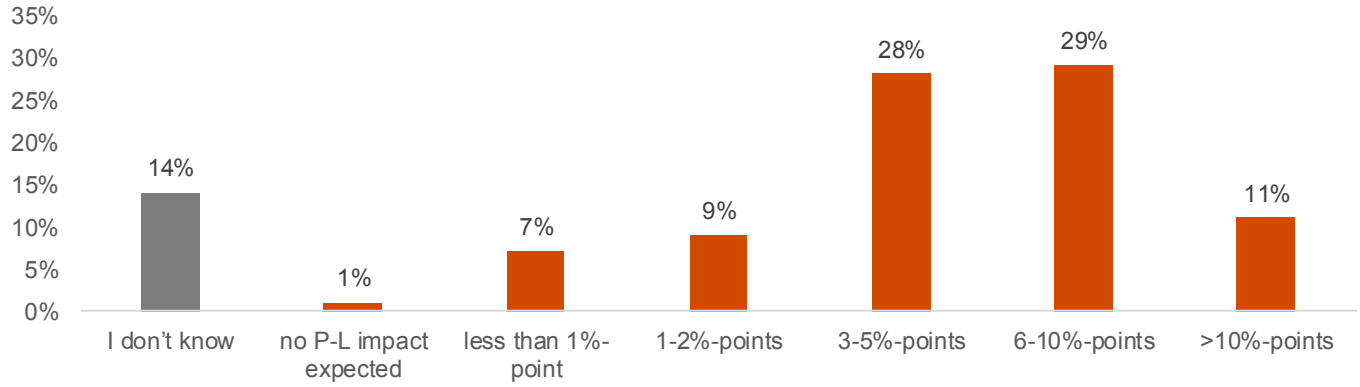
Manufacturing companies believe in AI's potential to increase profitability

Since the launch of ChatGPT in the fall of 2022 there has been an enormous amount of attention on GenAI as a way to increase efficiency across the entire enterprise. PwC's 28th Annual Global CEO Survey: Reinvention on the edge of tomorrow reported on some early results from companies adopting GenAI, with more than half of CEOs (56%) saying that it has resulted in efficiencies in how employees use their time, while around one-third report increased revenue (32%) and profitability (34%). That is slightly below the gains that CEOs expected to see last year, but they remain optimistic, with more than half expecting productivity gains over the year ahead. Investors and employees are similarly bullish; other PwC research on these groups shows similarly high expectations.

GenAI has significant potential for manufacturing companies too. It is now complementing many AI-driven solutions already in use in operations areas like supply chain and on the production floor and also offers great potential for R&D and procurement. So it is not surprising that the operations leaders surveyed are overwhelmingly positive about the potential for AI as a whole.

Nearly 70% expect it to increase their operating profit margin by at least three percentage points until 2030. And more than 40% anticipate an even greater rise of five percentage points in operating profit margins (see *Figure 1: Expected increase in operating profit margin through AI by 2030*).

Figure 1: Expected increase in operating profit margin through AI by 2030



Source: *AI in operations: Revolutionising the manufacturing industry*, Base 423.
Figures may not add up to 100% due to rounding.

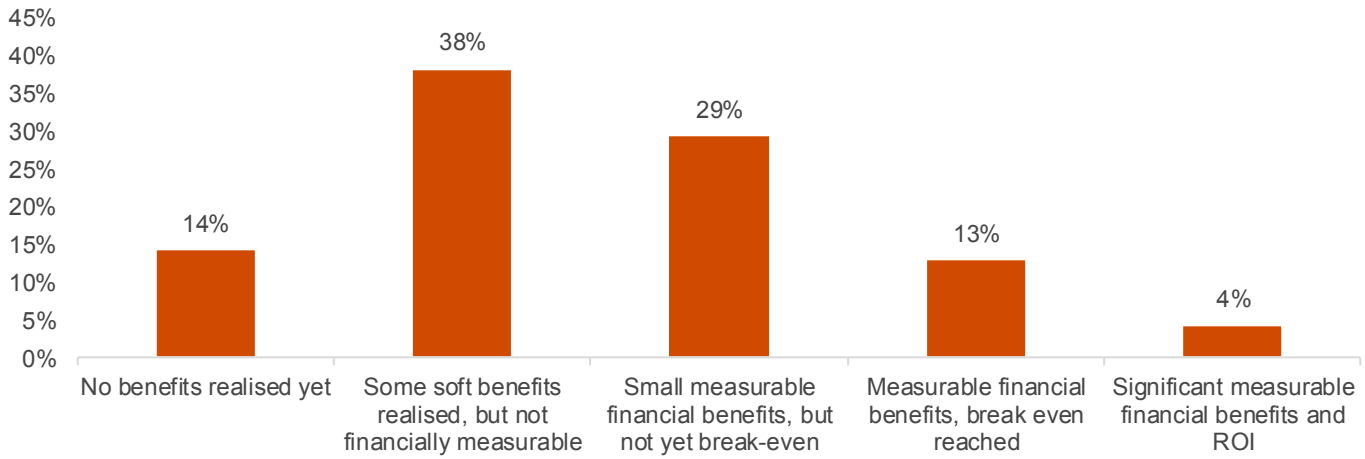
Optimism is highest in the retail and consumer goods sector, where 50% of companies anticipate an increase of more than 6 percentage points. Other sectors like aerospace and defence and automotive have more conservative expectations; it's also worth noting that 14% of respondents were not able to quantify the expected impact; pharmaceutical (pharma), life sciences and medical technology (med tech) respondents had the most difficulty in this area. Increasing the operating profit margin by five percentage points can have a dramatic impact in industry sectors with relatively tight profit margins, where these types of gains could translate into a 25-50% increase in the bottom line.

The research showed that companies that are further along on their AI journey tend to estimate potential financial benefits more conservatively. That makes sense. Experience in AI provides a more realistic understanding of challenges and potential organisational limitations. Persistence pays off, though. Once early adopters are able to move beyond initial setbacks and start achieving more significant gains, AI can eventually give them a real competitive advantage – if they stay the course.

Most manufacturers are already seeing benefits, but not yet achieving ROI

Getting to real ROI will still take some time. While more than 40% of companies surveyed are seeing at least some measurable financial benefit, and another 35% report soft benefits, most are not yet breaking even (see *Figure 2, Benefits already realised from AI*). And only a very small minority (4%) are already achieving significant benefits and ROI.

Figure 2: Benefits already realised from AI



Source: *The impact of AI on operations: Revolutionising the manufacturing industry,* Base Respondents using AI, 380.
Figures may not add up to 100% due to rounding.

It is important to put this finding into the context of overall AI maturity. The majority of respondents report that their companies are still getting started with AI. Less than a third have moved beyond the research or initial pilot stage to scaling AI across multiple departments, and only around 8% are true AI Operations Champions who are already systematically implementing AI across the enterprise and optimising and expanding its use (see *Figure 3: AI maturity*). As companies gain experience, they are likely to see greater benefits.

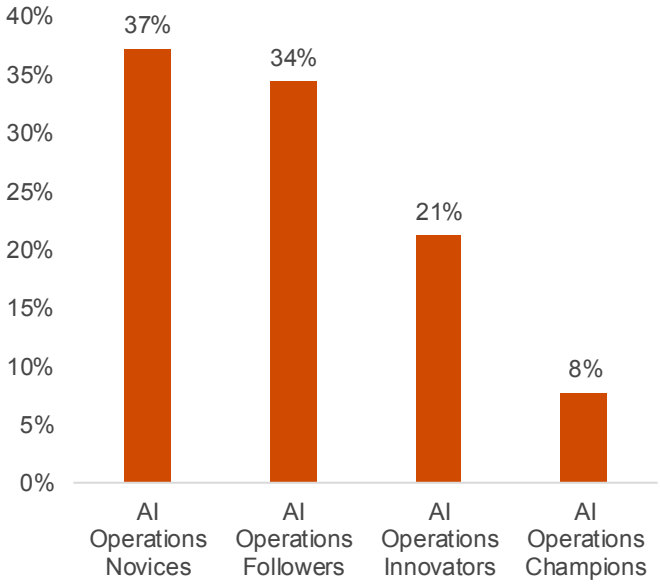
AI Operations Novices
Are not yet using AI in their business

AI Operations Followers
Have started deploying AI in selected areas or piloting projects to test its feasibility and benefits

AI Operations Innovators
Are in the process of scaling up their AI projects, integrating AI across multiple departments and operations

AI Operations Champions
Have fully integrated AI into their operations and are continuously optimising and expanding its use across the organisation

Figure 3: AI maturity



Source: *AI in operations: Revolutionising the manufacturing industry,* Base 423.
Figures may not add up to 100% due to rounding.

There are AI Operations Champions and AI Operations Innovators in every industry sector surveyed. And the ranks of AI Operations Champions include companies of all sizes; indeed, 7% of middle market companies (from US$1m – US$5m) have already reached this level of maturity.

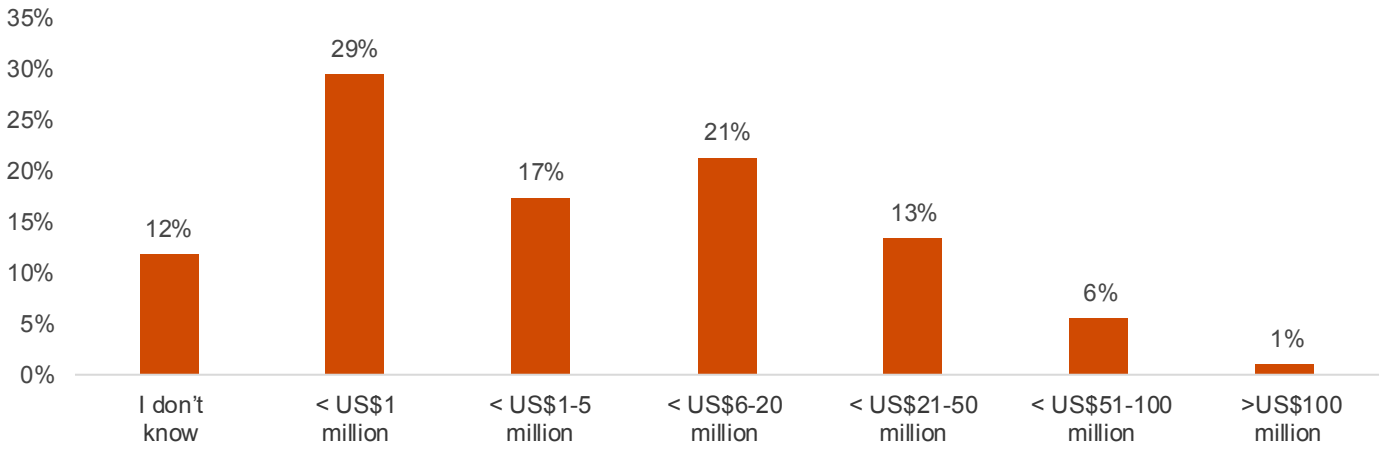
Investment will be needed to get to the next level

A fifth of executives (20%) reported that their companies invested more than US$20 million in their AI initiatives over the past five years (see *Figure 4, Current investments in AI*), and more than a quarter (24%) intend to invest at that level over the next three years as well. Although their total investment levels are lower in absolute terms, small and mid-sized companies (those with under US$5bn in revenues) are investing a significantly greater proportion of overall revenues in these initiatives.

While these levels of investment are encouraging, there are still a significant number of companies (19%) planning very modest levels of investment, or who have not yet defined their investment levels (16%), which may make it difficult to scale AI activities across the enterprise.

It has already been noted that achieving significant financial benefit and ultimately a solid ROI generally means moving beyond pilots and proofs of concept (POCs) and scaling AI across the organisation. It also requires investment. On average, the AI Operations Champions – the companies most advanced in AI use – are investing 20% more in AI solutions than the other companies surveyed. This remains a constant regardless of company size.

Figure 4: Investments in AI over the past five years



Source: *AI in operations: Revolutionising the manufacturing industry,* Base 423.
Figures may not add up to 100% due to rounding.

Adoption of AI in operations:
Benefits, preferred use cases and challenges

AI can help improve decision-making, productivity and flexibility, along with reducing costs and increasing sales and delivery volumes and prices

Even before companies can track measurable financial benefits, AI is having a positive impact on their businesses. Around a third of respondents using AI report that it has helped improve decision-making – and even more say their company has achieved soft efficiency gains in operational productivity and flexibility.

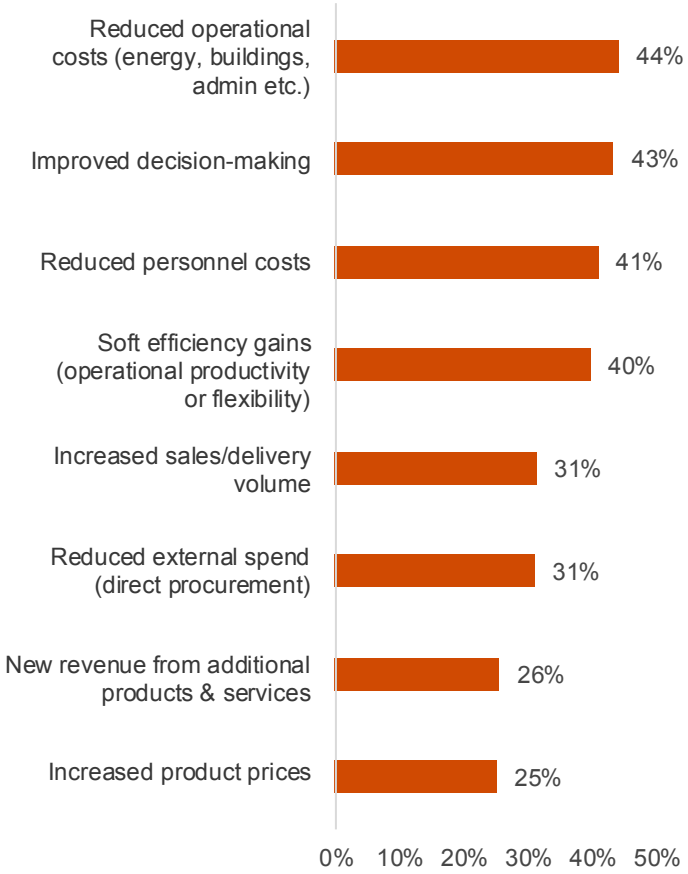
AI is also helping reduce many aspects of cost. Across the sample, the cost impact is greatest on operational areas including energy, buildings and administration, and on personnel costs. Some companies have also reduced external spend on direct procurement.

Profitability is being positively impacted in other ways too. Seventeen percent of respondents benefiting from AI say that it has increased sales and delivery volumes, while nearly as many report increased product prices (14%). Perhaps even more impressive: nearly two-fifths of companies benefiting from AI (19%) are already creating new revenue from additional products and services.

Not surprisingly, the more advanced companies surveyed – the AI Operations Champions and Innovators who are already scaling AI and even fully integrating it across their businesses – report these types of benefits in significantly greater numbers.

Looking forward, the number of respondents expecting positive impacts to their business goes up significantly, reflecting anticipated gains in maturity. More than two-fifths of respondents (44%) anticipate reduced operational costs, and nearly as many expect to improve decision-making, reduce personnel costs and achieve soft efficiency gains (see *Figure 5: Manufacturers expect AI to benefit both the top and the bottom line*). What's more, nearly a third of these respondents (31%) expect to increase sales or delivery volumes or reduce external spend, while around a quarter anticipate new revenue from products or services or increased product prices.

Figure 5: Manufacturers expect AI to benefit both the top and the bottom line through a variety of levers



Source: *AI in operations: Revolutionising the manufacturing industry,*
Base: 406.
Multiple selections possible.

These results suggest that companies may be able to harness benefits that go beyond operational improvements, for some companies, there may be potential to reinvent their business model. For example, companies that are able to quickly design new products may be able to offer new levels of personalisation to customers and open up new market segments, while more pricing power can help move a commodity producer up the value chain.

Filling skills gaps through AI

There are also workforce benefits that go beyond simply reducing personnel costs. In many industrial sectors, an aging workforce is creating the risk of serious skills shortages. AI solutions can help mitigate this not only by potentially lowering the overall staffing needs – they also offer direct assistance to operators and frontline workers, enabling less-experienced staff to handle tasks that once required extensive training, such as visual quality inspection. Technicians maintaining or repairing complex machinery can benefit from digital work instruction tools and GenAI-powered interfaces that allow them to access information quickly through natural language queries.

ANDRITZ AG, a globally leading supplier of process technologies, equipment, plants, automation and digitalisation solutions, is addressing this challenge through its AI-driven portfolio. In collaboration with Microsoft, ANDRITZ developed the Metris Copilot, which is built on Microsoft Azure OpenAI Services. The Metris Copilot combines anomaly detection with a generative AI chat interface to deliver real-time operational insights for plant personnel. Leveraging IoT sensors and machine learning, the solution proactively identifies and mitigates faults. It also uses agentic AI to autonomously employ agents for process optimisation and data visualisation tasks. The system's Digital Assistant interface enhances communication between humans and machines, helping to boost plant efficiency, product quality, and resource use.

Manufacturers are already exploring diverse use cases across all the core operations areas

Looking across the sample as a whole, supply chain emerges as the area of operations where the use of AI has advanced the furthest. Of the top ten use cases named by respondents, five were in the supply chain area. R&D and production each had two use cases in the top ten list, while procurement had just one. This reflects long-standing use of supply chain applications that are based on traditional AI in the industry sectors surveyed, for example demand forecasting and supply chain planning applications.

In the production space, approaches that draw on both traditional AI and GenAI are beginning to gain traction, while procurement is just starting its journey as a highly promising area for new applications of GenAI and agentic AI (see Reducing the need for manual verification in the procurement process). Looking forward, interest in nearly all of the use cases explored is growing significantly, with procurement showing the greatest jump.

Reducing the need for manual verification in the procurement process:

AI-powered commodity code assignment as starting point for scaling automation in procurement operations

A large commercial vehicle manufacturer has streamlined its procurement process by automating the task of assigning commodity codes, thus improving the handling of low-value orders. Despite having a digital system in place, the need to manually verify orders posed severe challenges. Per year, more than 40,000 orders under €25,000 needed to be checked manually by the operational procurement teams, in particular, to correctly assign commodity codes which were not commonly defined across different groups.

To tackle these challenges, an AI solution that uses advanced models to enhance document classification and code assignment was introduced, along with a strategy to ensure reliable data extraction and validation, making the AI solution more dependable. Automation tools were integrated with existing systems to create a flexible setup that can be improved over time.
The solution draws on data stored in SAP ERP systems and uses RPA agents integrated with Microsoft Azure OpenAI Service.

The result of this AI implementation is threefold: First, procurement staff spend less time on low value-added tasks like commodity code assignment, which is now automated for more than 80% of low-value orders. Second, the accuracy of code assignments has improved, thereby increasing data quality and avoiding process issues. Third, procurement staff satisfaction has increased massively since people do fewer operational tasks that are 'boring but necessary'.

Based on this use case and the underlying architecture and technology, the company is now quickly scaling AI to incrementally automate other procurement processes like supplier and price validation, order confirmation handling, purchase order (PO) changes, and more to realise further efficiency gains.

Automotive companies are the most mature, especially on using AI in production use cases

Results of the research revealed significant variations in the use of AI by industry. The automotive sector was the most mature of the industries surveyed. Some use cases, like supply chain risk prediction and quality control, are already reported in use by significant numbers of automotive respondents; see *Improving visual quality inspection at ZF Group* for an example of how a quality control application works in practice. Automotive companies are placing the most emphasis on using AI in the production space, with many also using predictive maintenance for production assets, production process optimisation, work instruction assistance, detailed production scheduling optimisation and energy efficiency optimisation. When it comes to R&D, product testing and simulation is by far the most popular use case;[1] simulation technology has been used for computer-aided engineering (CAE) tools in the automotive industry for more than two decades, for example to supplement physical crash testing using dummies with virtual simulations.

1. It should be noted here that the list of use cases in the survey questionnaire only included physical products; respondents were not asked about their use of AI or GenAI tools in software design. The experience PwC and Microsoft have gained working with their respective clients and customers suggests that these have also gained a high level of popularity in recent years.

Improving visual quality inspection at ZF

ZF Group (ZF) is a global technology company supplying advanced mobility products and systems for passenger cars, commercial vehicles and industrial technology. ZF began its AI transformation over a decade ago with initial machine learning (ML) pilots at specific manufacturing sites. Recognising the need for foundational technology, ZF invested in a data lake, advanced analytics platform, and its Digital Manufacturing Platform (DMP), which connects production assets to a modern data and AI stack in Microsoft Azure.

One key AI use case on the DMP is "AI-based visual quality inspection," which significantly enhances the visual quality inspection process of parts across ZF's global production sites. This AI application increases production throughput and overall equipment effectiveness (OEE) by enabling faster, better detection of defects.

After a successful pilot, ZF faced challenges to scale this solution to production machines / lines across its more than 200 plants around the world. As one of the world's largest automotive suppliers, ZF has a very broad portfolio and variety of produced parts. Production machines and camera installations varied across sites, with some lacking shopfloor connectivity and having differing data standards and MLOps routines.

To overcome these issues ZF implemented the "Computer Vision Toolbox" integrated with Microsoft Azure, which standardises and automates the end-to-end AI lifecycle from model training through testing, deployment, monitoring and continuous improvement across cloud and edge infrastructure. ZF has already deployed the toolbox for over ten use cases and aims to scale this to more than 800 use cases by 2030.

Industrial products companies are making the most of production and supply chain use cases

Industrial products companies in both discrete and process manufacturing are exploring production use cases and are most advanced in the areas of quality control and production process optimisation. Both sectors also emphasise several supply chain use cases, like supply chain risk prediction, demand forecasting, and supply chain planning.

These types of applications help companies cope with market volatility and support supply chains in being resilient, for example by using machine learning to forecast demand more accurately. Process manufacturers are also more likely to be using applications for product design generation, for example for new formulations, and optimisation. As in several other sectors, procurement is the least well-developed of the operations areas explored.

Pharma, life sciences and med tech companies are leveraging the full spectrum of AI use cases

The survey results show that these sectors are active in the R&D space, particularly in their use of product testing and simulation and product design generation and optimisation. GenAI has already begun making an impact with companies now exploring solutions that help enhance drug discovery.

The technology is also making it easier to manage complicated regulatory requirements, for example around clinical testing. Large language models (LLMs) such as the ones integrated in the Microsoft 'AI for Science' platform can also help.

Companies in the pharma, life sciences and med tech sectors are also employing many of the same production and supply chain solutions used in the automotive and industrial products sectors. A recent PwC Strategy& report, *Re-inventing Pharma with Artificial Intelligence*, suggests that operations has the highest AI potential in the pharmaceuticals value chain as it represents such a large part of the cost base.

Aerospace and defence and retail and consumer show lower adoption rates

The aerospace and defence and retail and consumer goods sectors showed rates of adoption of individual use cases that were noticeably lower than in the other sectors. In the retail and consumer space, this may be a result of a greater emphasis on using AI in areas like marketing and customer service rather than the operations areas that are the focus of this study. It should be noted that there are pioneering companies in these sectors, too. For example, 9% of aerospace and defence respondents are in the AI Operations Champions group.

Figure 6: Leading sectors and AI use cases in core operations areas

	Leading sectors	Top use cases
R&D	Automotive; pharma, life sciences and med tech; industrial products - discrete manufacturing; industrial products - process industries	Product design generation and optimisation, product testing and simulation
Supply chain	Transport and logistics; pharma, life sciences and med tech; industrial products - process industries; industrial products - discrete manufacturing	Supply chain planning, supply chain risk prediction, demand forecasting
Procurement	Pharma, life sciences and med tech; transport and logistics; automotive	Supplier selection and management, automated P2P document and inquiry management (current), risk management (future)
Production	Industrial products - process industries; industrial products - discrete manufacturing; automotive	Quality control, production process optimisation

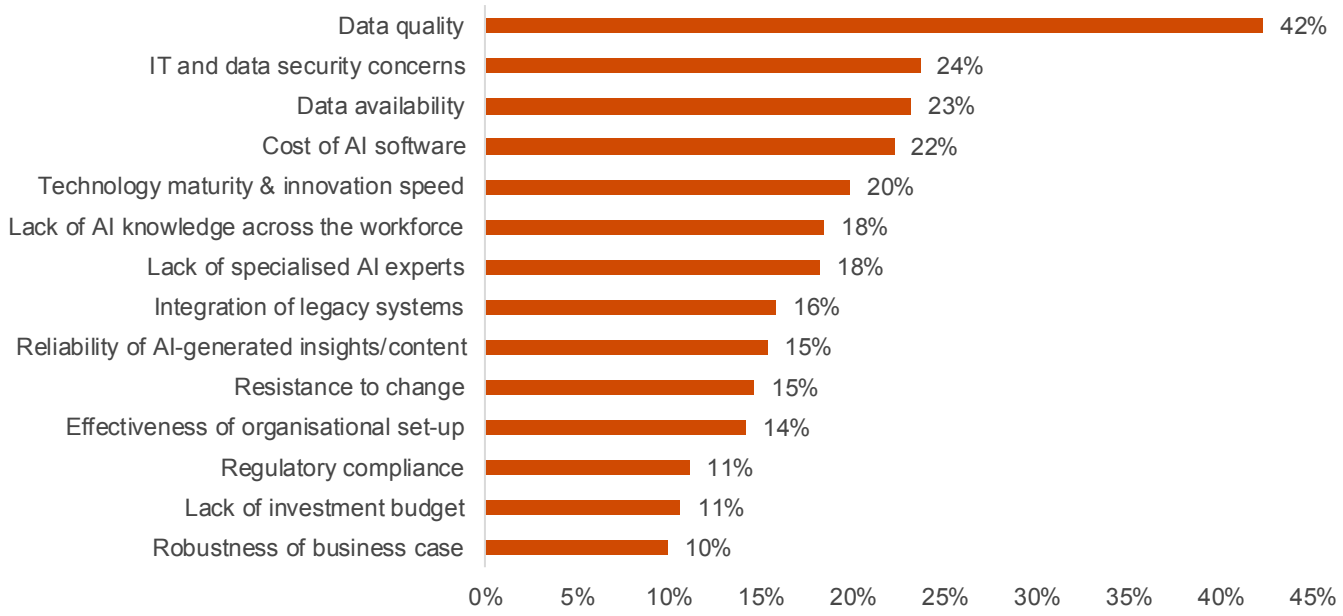
Source: *AI in operations: Revolutionising the manufacturing industry.*
Base: respondents deploying use cases in core operations areas, 316.

Data challenges top manufacturers' list of concerns

Data stands out as the biggest challenge companies face, with data quality the most cited concern (see *Figure 7, Top challenges to implementing AI in operations*). Many manufacturers are coping with a heterogeneous IT/OT (operational technology) system landscape and vast amounts of unstructured data (machine logs, documents, images and more) that need to be collected, integrated, and prepared before they can be used by AI models.

In factory settings, cloud and edge computing components may need to work hand in hand for data to be exchanged seamlessly and for AI models to interact correctly. Pre-trained AI models are also being adapted to these needs. For instance, the newly emerging small language model (SLM) trend provides language models which can be run on local infrastructure, in contrast to LLMs which require extensive cloud infrastructure.

Figure 7: Top challenges to implementing AI in Operations



Source: *AI in operations: Revolutionising the manufacturing industry,* Base 423. Respondents could select up to 3 choices.

Not surprisingly, the area of IT and data security is another of the key challenges highlighted by survey respondents. Some respondents are also concerned about data availability. Some additional key considerations on data platforms are explored later in this study.

For a more detailed discussion of cybersecurity considerations, please see *'How to deploy AI at scale: a PwC and Microsoft playbook that explores the critical role of cloud and cybersecurity.'*

Keeping up with the speed of change and developing AI expertise are also hurdles

Companies are also struggling with the maturity of AI technology and speed of innovation. New AI models are being released nearly every week and keeping up with which technologies are most fit for purpose can be tough. LLMs tend to get the most attention, with various new releases from OpenAI, Google, Meta, and Chinese start-up DeepSeek, among others, all making news at the end of 2024 and the beginning of 2025.

Scientific models are expanding rapidly too. For example, the Microsoft MatterGen[2] tool is designed to spark materials innovation by generating new materials for specific applications through prompts. Designers can use the tool to engineer better products.

Many companies also say they lack specialised AI expertise and sufficient AI knowledge in the broader workforce. Both are urgently needed.

Companies need to evaluate and understand how AI and GenAI tools can streamline processes and to make sure that they are used consistently and responsibly.

European companies must also educate their staff to comply with the EU AI Act. In particular, Article 4 of the Act requires both providers and deployers of AI to 'take measures to ensure, to their best extent, a sufficient level of AI literacy of their staff and other persons dealing with the operation and use of AI systems on their behalf.'[3]

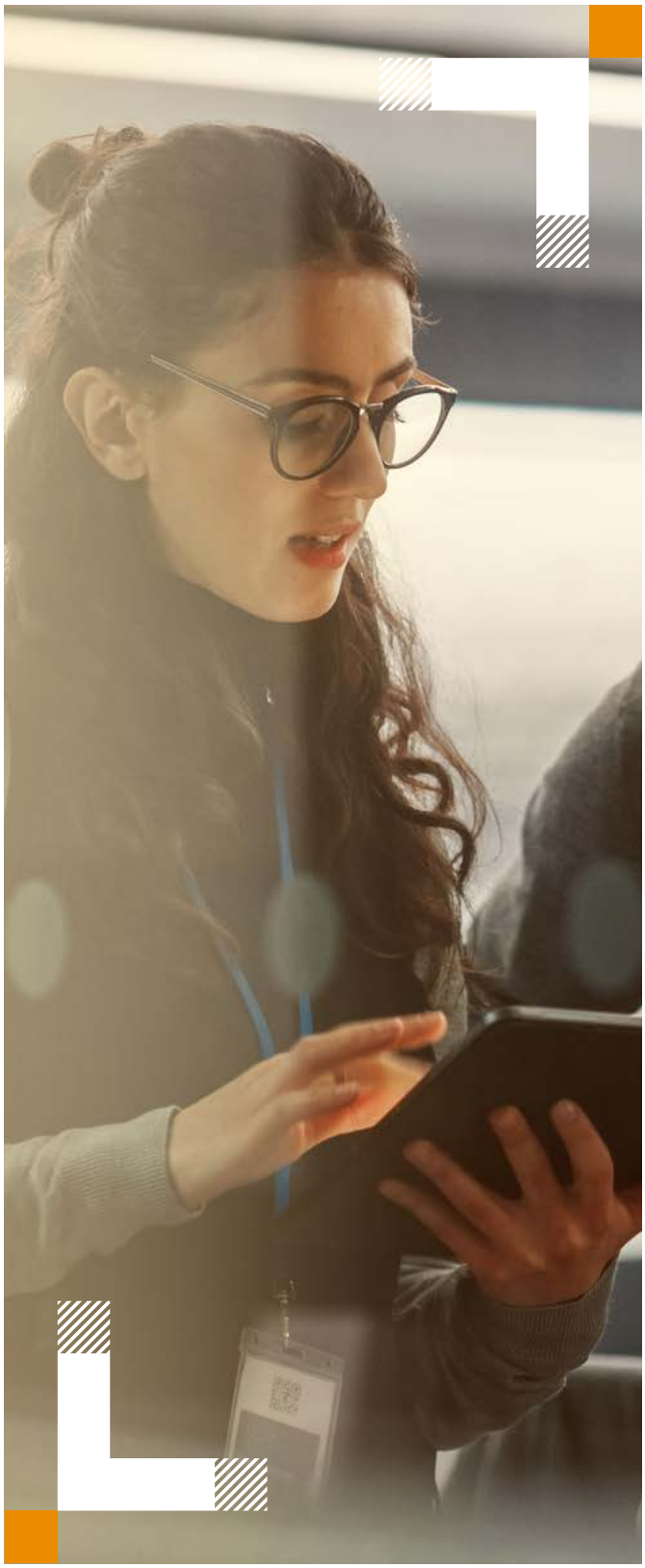
One encouraging sign: lack of investment budget or robustness of the business case ranked at the bottom of the list of challenges, suggesting that respondents already understand the need to invest and are able to make a case for it to management.

2. https://www.microsoft.com/en-us/research/blog/mattergen-a-new-paradigm-of-materials-design-with-generative-ai/

3. See https://www.pwc.nl/en/services/audit-assurance/pwc-accountancy-insights/data-it-and-internal-control/ai-literacy-under-the-eu-ai-act.html for more detailed information.

Accelerating your AI journey

As already noted, many companies are still struggling to achieve ROI from their AI initiatives. Based on the results of PwC's research, along with discussions with diverse manufacturing clients and customers at different stages of their AI journeys, PwC and Microsoft have jointly identified four core principles that are critical to getting the most value from AI.
To help companies put these ideas into practice, this section also highlights what the most advanced companies, the AI Operations Champions, are already doing to drive successful implementation of AI across their organisations.



01 **Define a clear AI strategy for operations that is aligned with your overall business goals and technology strategy and sponsored by leadership**

02 **Focus on use cases that deliver short-term ROI while keeping the bigger picture in mind**

03 **Build a strong technology and data foundation for AI**

04 **Emphasise strong organisational structures and robust AI governance**

01. Define a clear AI strategy for operations that is aligned with your overall business goals and technology strategy and sponsored by leadership

The first step to making the most of AI in your operations function is to clearly define and articulate a compelling vision for how you intend to use AI across your business. To do this, you'll need a strong understanding of the external factors that are impacting transformation in your industry. That includes keeping up with the competitive landscape and how your peers are using AI. It also requires staying abreast with the regulatory environment, particularly when it comes to new regulations on AI and the use of data.

It's also critical to get strong support from the CEO and broader leadership as you develop these plans. AI strategy is not just about technology, it impacts your entire business. For example, when manufacturing companies use AI to run operations more autonomously, a wide range of processes will be impacted. These changes may drive the need for an entirely new operating model set-up for operations. The right 'tone from the top' is essential to driving implementation throughout your organisation.

One you have clarified your vision, it is time to define a clear 'way to play' and consider how AI can build on your organisation's strengths and support opportunities for future growth or enhanced efficiency.

Are you a quality leader in your industry?

Then it might make sense to use AI to further your lead on quality and safety.

Does your business need to increase production capacity?

If yes look for ways to use AI automation to source and increase output with the same size workforce.

Losing market share?

It could be the right time to reinvent your business models by using new AI-generated designs.

Is your profitability declining?

Consider consolidating existing product variants using AI.

These are just a few of the possibilities. Many more areas could be considered. Based on your preferred ways to play, you can set a strategic direction and translate it into a distinct selection of AI use cases, technologies and organisational capabilities that you need to invest in. These should be clearly documented in an overall strategy roadmap with defined targets, including anticipated short and long-term benefits. It is also important to assign clear responsibilities within the organisation and understand what capabilities may still need to be developed.

You will also need to understand how AI might change your employees' day-to-day work and the skills they require. Managing internal change and addressing potential concerns about job impacts should be considered from the beginning of the AI adoption process.

> **AI is revolutionising the approach to operations by drastically reducing the time needed for a whole range of core operations processes, from R&D and supply chain to production and procurement. As AI evolves into an indispensable decision support assistant, it will not only enhance decision-making processes but also autonomously handle repetitive tasks, driving efficiency and innovation."**
>
> – Stefan Schrauf, Global Supply Chain and EMEA Operations Transformation Co-Leader, Partner, PwC Germany

02. Focus on use cases that deliver short-term ROI while keeping the bigger picture in mind

There are an impressive number of interesting use cases for operations functions. However, it is critical to take a systematic approach and develop use cases that are complementary. You should also focus on use cases that support the specific capabilities and business goals you want to achieve as defined in your vision and set out in your strategy roadmap.

For example, if your goal is to improve process monitoring and control in order to lead on cost, you might select use cases that help you monitor the production process, improve quality control, or enhance production scheduling. Rather than trials of diverse use cases in isolation, it is more productive to plan how to build on use cases over time.

Setting up demand forecasting can pave the way to streamlining procurement processes by providing more accurate data on materials requirements, for example.

Given the current cost pressure in manufacturing industries, short-term ROI is often mandatory to secure required fundings. Here are some additional strategies that can help you accelerate the road to ROI. These can be especially helpful for small- and mid-sized businesses with fewer resources – companies that will typically find it more challenging to develop AI capabilities or create differentiated AI applications on their own.

Use out-of-the-box features to reduce cost

Many organisations already have AI capabilities in their tech stack that are not yet being fully used. In the future additional functionality will likely be embedded into a wide range of everyday tools. Taking a careful look at what your tech stack could deliver is a great starting point to harness the power of AI. For example, some enterprise resource planning (ERP) and customer relationship management (CRM) solutions now offer built-in AI functionality. Microsoft Copilot in Microsoft Dynamics 365 offers built-in AI-powered experiences for select licenses at no additional cost. Such existing solutions can already harness the power of GenAI to help workers complete complex tasks and resolve issues faster and new tools are being added on a regular basis.

Other business software is getting superpowers as well. Companies using Microsoft 365 – including popular applications like Word and Powerpoint – can take advantage of Microsoft 365 Copilot to add efficiency to operations processes. For example, these tools can be used to support contract management or automated purchase-to-pay (P2P) document and enquiry management in the procurement space or to accelerate market research and expert search in engineering. Taking full advantage of these built-in resources like Microsoft 365 Copilot can also support other business functions like customer service, sales and marketing, finance and human resources.

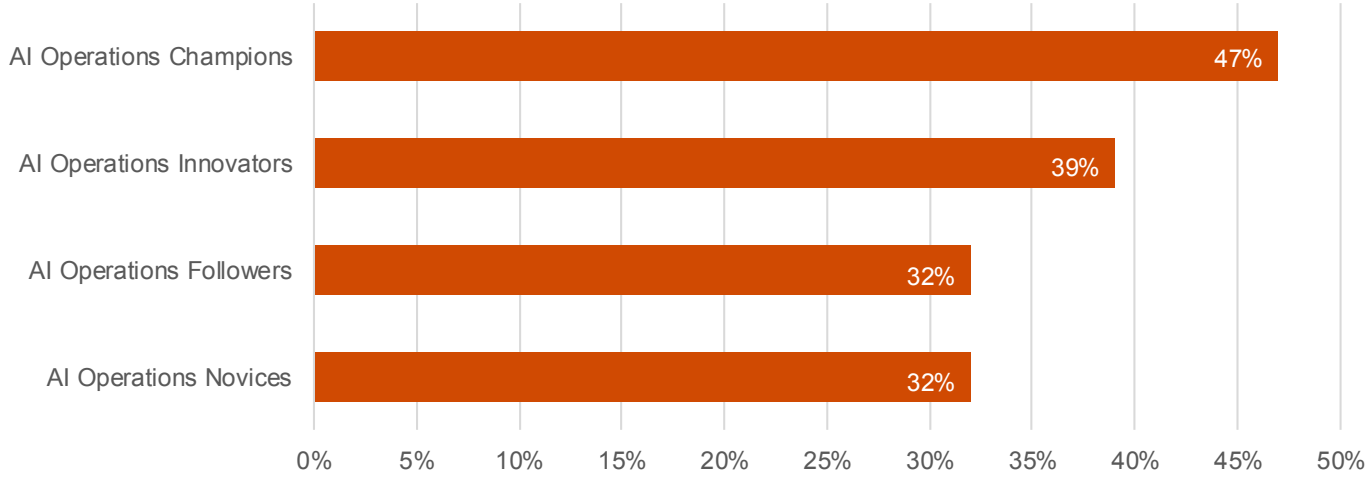
Make the most of GenAI as a launchpad

GenAI offers great opportunities to monetise quick-win use cases. It is typically a lot easier to get started with GenAI projects compared to more traditional machine learning use cases. The survey results show that companies who have already achieved measurable financial benefits from AI in operations are making greater use of GenAI compared to the rest of the survey sample. That is particularly clear when you consider how AI Operations Champions are leveraging GenAI within their AI use case portfolio. On average, AI Operations Champions are using GenAI for nearly half of the use cases they are developing. That is significantly higher than their less mature peers (see *Figure 8*).

GenAI solutions can be especially effective for highly standardised, transactional processes such as in operational procurement. They can also be used for aspects of research, development and engineering.[4] For example, some manufacturers now use GenAI to accelerate their requirements engineering process. By using GenAI to classify and compare customer requirements, companies are able to reduce their manual effort and deliver a much faster response to inquiries from customers.

> **Use cases in R&D and Procurement are particularly promising, accelerated by the use of GenAI. Both offer great potential to achieve impressive gains in efficiency with short payback periods."**
>
> – Ygal Levy, EMEA Manufacturing, Managing Director, Microsoft

Figure 8: Average percentage of GenAI use cases within the currently developed AI use case portfolio by AI maturity level



Source: *The impact of AI on operations: Revolutionising the manufacturing industry,* Base 423. Responses of don't know excluded.

4. For more detailed guidance, please see PwC Germany's report, Unleashing the potential of GenAI in Manufacturing.

These kinds of innovative solutions are not just for the very largest companies – middle market players can succeed too. One German family business in the electronics segment is using GenAI to dramatically accelerate the design of tailored products. By providing website users a natural-language interface to their highly extensive product portfolio, this manufacturer is also radically improving their customers' experience.

PwC's experience suggests that beginners should start with separate GenAI use cases for each operations function, bearing in mind the overall vision established in the AI strategy and how similar technical structures can be leveraged in other functions. For example, the framework designed for an operational procurement assistant could be reused to develop an operational sales assistant. Companies who have already begun scaling AI can take a more ambitious approach, by designing cross-functional use cases and deploying AI solutions with greater complexity.

Either way it is critical to involve the employees that will be working with the solutions. The most impactful ideas often come directly from the shop floor, where workers can help identify which tasks should be automated to gain the most efficiencies.

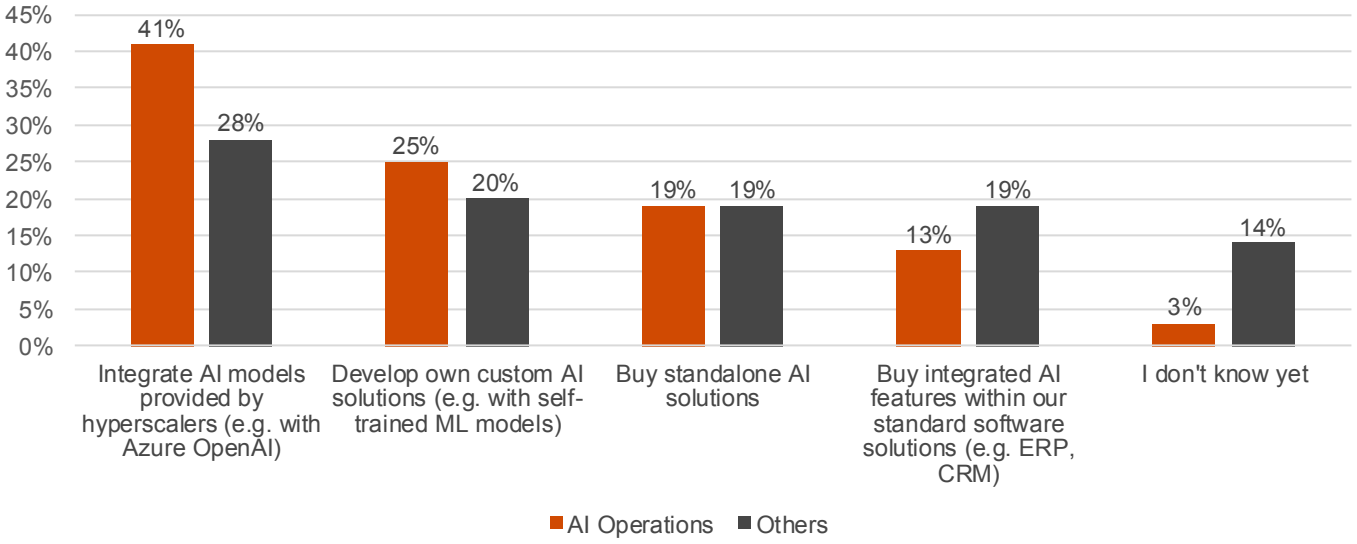
If you are looking for quick wins, the procurement process may be especially promising. GenAI tools can often be integrated with a modest investment to speed decision-making and contact-to-cash processes. More sophisticated agentic approaches can even take over some repetitive tasks autonomously. At the beginning of 2025, PwC and Microsoft announced a strategic collaboration aimed at transforming industries with the power of AI agents.[5]

Carefully consider make-or-buy decisions

Our survey showed that AI Operations Champions are most focused on integrating hyperscaler-provided AI models and developing custom AI solutions, reflecting their greater maturity (see *Figure 9, AI implementation approach*). Both of these options require significant in-house capabilities.

Less advanced companies are also starting to take on both model options, but in somewhat smaller numbers. They are currently more inclined to buy standalone AI solutions or integrate AI features already included in standard software solutions, such as for ERP and CRM systems.

Figure 9: AI implementation approach



Source: *AI in operations: Revolutionising the manufacturing industry,* Base 423. Figures may not add up to 100% due to rounding. "Others" includes AI Operations Innovators, Followers and Novices.

5. See https://www.pwc.com/gx/en/news-room/press-releases/2025/pwc-and-microsoft-strategic-collaboration.html

03. Build a strong technology and data foundation for AI

Once you have defined your strategy roadmap and carefully selected which use cases you intend to pursue, you will need to assess your technology infrastructure. Each use case may need different data and technical AI features, but it is important to consider the entire picture. An integrated data and AI tech stack will establish the foundations needed to scale a comprehensive portfolio of AI use cases across the entire organisation. Building siloed solutions for each use case limits re-usability of components and will thus have a higher total cost of ownership in the long run.

This tech stack should comprise two key components:

1. A robust data platform

Operations data, especially when collected from suppliers as well as production sites, is very heterogenous and typically difficult to use when not properly integrated and curated. As already noted, data quality, data availability and data security are all key challenges for respondents. Many companies struggle with collecting, cleaning and standardising data from multiple sources, which is essential for effective AI models.

Your organisation needs to establish a modern data platform that allows for different data ingestion patterns (batch, stream, event-based, virtualised), and integrates and curates this data through a layered data architecture (e.g. based on Microsoft Azure, with bronze, silver, and gold zones offering increasing levels of data quality and usability).

2. AI toolchain

Operations use cases may require different AI models, from self-trained regression or classification ML models (e.g. in AzureML) to pre-trained large language models consumed as a service, for example through Microsoft Azure OpenAI Service, enriched with your own data. And to fully close the automation loop on some use cases, AI models need to be integrated into intelligent digital workflows, e.g. with Microsoft Copilot Studio or with Microsoft PowerPlatform. Your enterprise needs a flexible AI toolbox that supports these different AI usage patterns and connects them to your data platform in one fully integrated technical environment.

> **Looking into the future, it's critical to establish a solid data platform that consolidates all of your data estates to provide a solid foundation for more ambitious use cases. If you have no data, there's no AI."**
>
> – Rupert Stuetzle, EMEA Manufacturing and Mobility, General Manager, Microsoft

More strategies to help you build a solid technology and data foundation for AI applications:

Choose your partners wisely

It is important to choose technology partners strategically and consider which AI capabilities they bring to your business ecosystem. That's relevant for security issues, however bringing in a strong technology partner with the right capabilities, industry knowledge and functional expertise can also help at other stages of your implementation journey. It is equally essential to tap into proven industry expertise and knowledge to overcome barriers to implementation. In this way, the journey to AI will be smoother and easier to get off the ground.

Keep up with the latest trends

It is also critical to keep abreast with AI developments. New innovations in the AI software market are evolving at great speed: solutions that are not yet functional in your environment might work well in the near future. Stay close to your technology partners to discover what new AI capabilities they are planning to release that might be useful for your business further down the line. And finally, keep an eye on emerging AI startup businesses that could help you deliver on your core AI use-case priorities.

04. Emphasise strong organisational structures and robust AI governance

Central coordination across the business is critical to long-term success

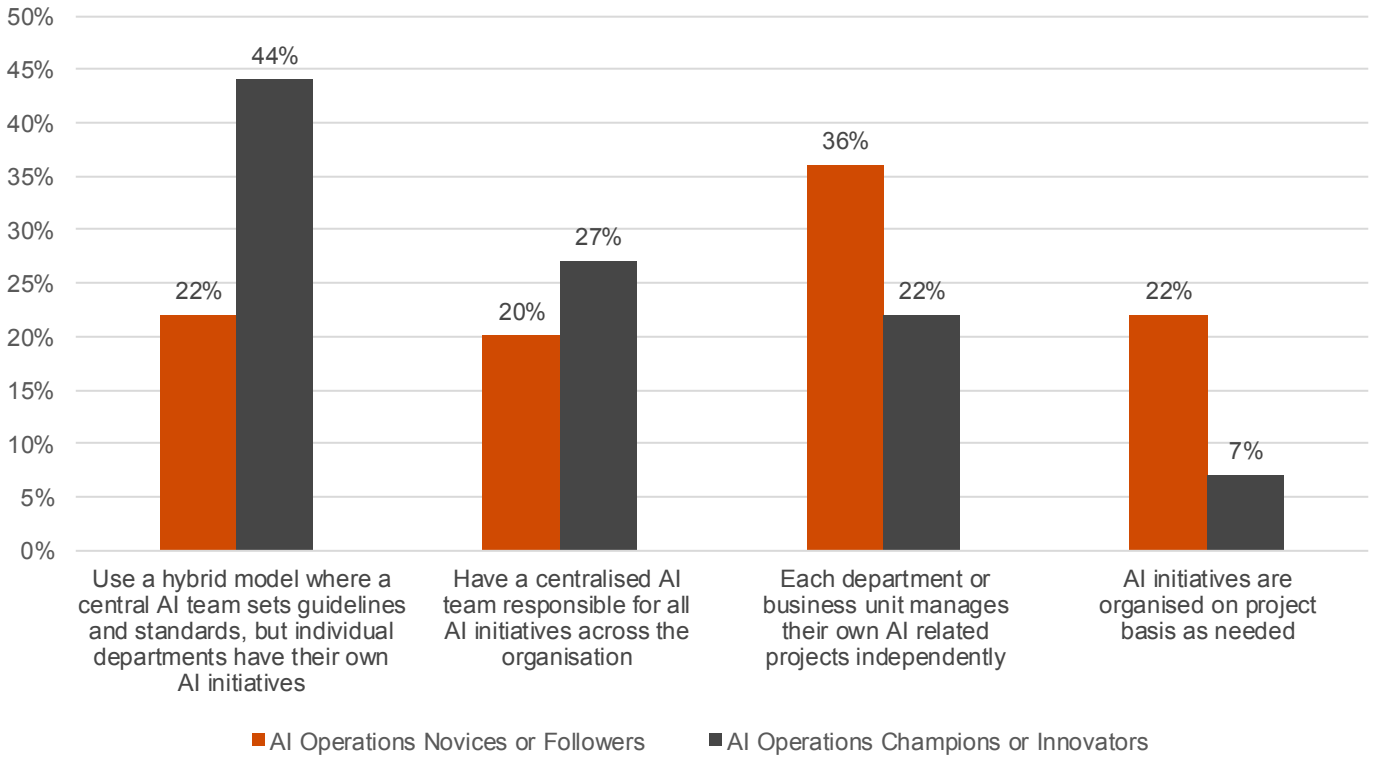
Strong organisational structures and processes are essential to steering and delivering a defined AI strategy roadmap. AI Operations Novices and Followers often lack coordinated governance; over half are using uncoordinated, non-centralised organisational structures. In contrast, 71% of AI Operations Champions and Innovators are using an organisational governance model that integrates a central AI team (see *Figure 10, Management and governance of AI initiatives*).

Ensuring coordination across the business is especially vital for operations functions. In the production environment, for example, there is an increased need to bring IT and OT capabilities together to make an impact, and procurement solutions may touch on other functions across the business. Establishing a central AI function that can serve as a 'transformation office' – ideally headed up by a Chief AI Officer – is essential. Setting up a strong central programme that provides the building blocks and direction for your entire organisation helps address key challenges posed by AI, for example around data platforms. This also makes it possible to create synergies across different functional and geographic areas.

The experience that PwC and Microsoft have gained working with their respective clients and customers suggests that the most effective option for most companies is a hybrid or 'hub and spoke' model, where a central team sets guidelines and standards but individual departments are still responsible for their own initiatives. Forty-four percent of AI Operations Champions and Innovators report their companies are organised in this way, compared to just 22% of AI Operations Novices and Followers.

Some companies make the mistake of expecting disparate PoCs and isolated used cases to scale naturally, without any central direction. Indeed, anecdotal evidence suggests that a lack of coordination may be one of the primary reasons companies fail to achieve the value they expect from AI. Organisations that are able to combine top-down guidance and structure with bottom-up idea generation and commitment are best positioned to achieve success.

Figure 10: Management and governance of AI initiatives



Source: *AI in operations: Revolutionising the manufacturing industry,* Base 423. Figures may not add up to 100% due to rounding.

PwC experience working with clients suggests that AI Operations Champions are growing their AI capabilities by hiring AI experts, developing specialist AI expertise, and educating the broader workforce. They have also created partnerships with external professional service providers and hyperscalers, such as Microsoft, to take advantage of new and emerging AI innovations for enterprise-ready cloud environments.

By developing in-house AI proficiencies, these companies give themselves a clear competitive advantage. They are better established to grow their use of AI even further and attract fresh AI talent to their businesses. Implementing robust governance structures also supports data integrity by confirming data is validated and monitored, and that processes are in place to quickly detect and correct additional errors in the data.

Going forward, operational transparency will become the norm. Current and future performance of operational functions will be readily accessible and visible to those that need it, and data quality will be far superior to that of today. Jobs within operations will change significantly. Creative roles will become more important, and those working with data in a decision-support role will find their jobs enhanced or augmented by AI-powered cognitive analytics."

– Alistair Kett, UK Enterprise and Operations Transformation Lead and EMEA Operations Transformation Co-Leader, Partner, PwC United Kingdom

Trust in AI

Building trust in AI will be table stakes for customers, regulators and employees. Companies need to be confident in the integrity of solutions that will have such a dramatic impact on their business. Trust is critical to reap the rewards of GenAI too. The results of *PwC's 28th Annual Global CEO Survey: Reinvention on the edge of tomorrow* highlight this clearly: while only one in three CEOs say they have a high degree of trust in having AI embedded into key business processes, those who do trust AI report higher gains from GenAI over the last 12 months and expect higher gains in the future.

To get there, PwC and Microsoft recommend using responsible AI practices. These should emphasise trust by design, which means embedding best practices throughout AI development and deployment processes. The strategy + business article *'From principles to practice: Responsible AI in action'* provides more information on PwC's approach, including its Responsible AI Toolkit that provides a foundation for trust-building practices that support the transparent, accountable and fair use of AI. Microsoft has also developed a full range of responsible AI tools.

Taking a responsible approach will be critical to getting the most from AI and confirming future compliance with regulations like the EU AI Act, which was published in August 2024. Its rules are gradually coming into effect over the next few years, with the first provisions (including an AI literacy requirement for staff using AI applications) applying from 2 February 2025. Prohibited applications also need to be discontinued from this date, and companies have until August 2026 to achieve compliance with other key rules, such as those that apply to high-risk applications.

Creating clear guidance on responsible AI principles and upskilling all employees accordingly is important, but guiding principles will not be enough on their own. Companies will also need to ensure that the guidelines and policies established are fully implemented in day-to-day operations. Maintaining a robust dialogue with regulators and with peers who are implementing the Act will also be important, as interpretations may evolve.

Closing thoughts

AI is transforming manufacturing industries. The question is no longer if or how it will impact their operations, but rather how fast. *PwC's 28th Annual Global CEO Survey: Reinvention on the edge of tomorrow* shows that chief executives understand that. Operations leaders need to quickly follow suit and make bold decisions as well.

AI is complex. Many pieces of the puzzle need to come together to successfully scale AI use cases across the organisation and realise tangible business benefits. However, operations leaders should not wait any longer to see how AI evolves before setting out their AI strategy and committing to AI investments. The longer they wait, the greater the risk of losing ground to more ambitious competitors. The research shows that AI Operations Champions are already leading the way in every industry studied and that some use cases are already achieving measurable returns.

In the current economic situation, focusing on the use cases most likely to deliver short-term ROI, especially using GenAI, and co-investing with strong software and professional services partners can ensure that companies do not get left behind, even when resources are scarce. Taking care to use responsible AI practices is also essential to build trust in AI. That's particularly important as companies start to take advantage of AI's potential to act autonomously. By establishing a solid foundation, companies can use AI not just to fine-tune individual processes, but to revolutionise operations.

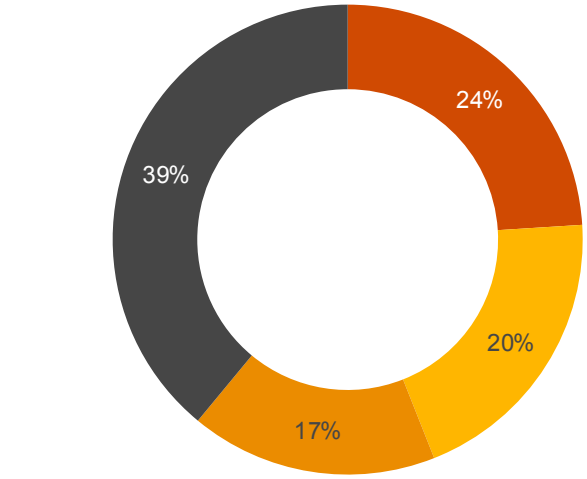
Methodology

This report draws on the results of a survey conducted by PwC and an independent research firm across 423 companies headquartered in 31 countries across Europe, the Middle East, and Africa, including Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Israel, Italy, Jordan, Lebanon, Luxembourg, the Netherlands, Norway, Poland, Portugal, Qatar, Romania, Saudi Arabia, Slovakia, Slovenia, South Africa, Spain, Sweden, Switzerland, Turkey, United Arab Emirates, and the United Kingdom.

Executives within the operations, research and development, procurement, supply chain and production functions were interviewed. Respondents come from a range of job roles, made up of chief operating officer (COO), chief technology officer (CTO), senior vice president (SVP), vice president (VP), director and manager levels.

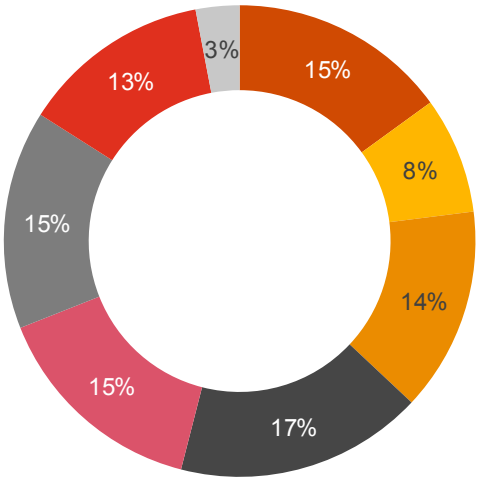
A broad revenue range was examined, from companies generating less than $1 billion in revenue to those earning above $10 billion. The employee count, which does not necessarily relate to revenue, ranges from under 1,000 employees to above 30,000 employees. Interviews focused on select business sectors, primarily in manufacturing. These encompass the automotive; aerospace and defence; industrial products – discrete manufacturing; industrial products – process manufacturing; pharmaceuticals, life sciences and medical technology; retail and consumer goods; and transport and logistics sectors.

Figure 11: Sample split by company size



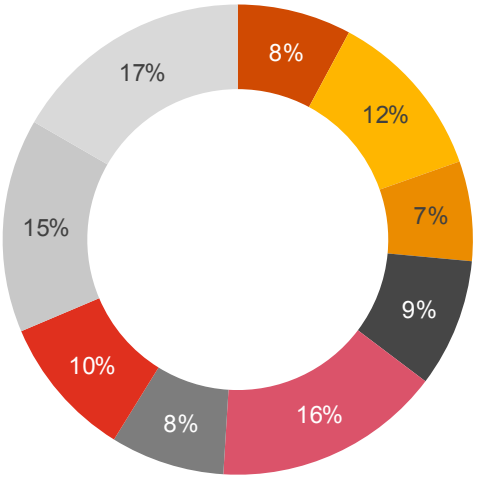
Source: *AI in operations: Revolutionising the manufacturing industry,* Base 423.

Figure 12: Sample split by industry sector



Source: *AI in operations: Revolutionising the manufacturing industry,* Base 423.

Figure 13: Sample split by region



Source: *AI in operations: Revolutionising the manufacturing industry,* Base 423.

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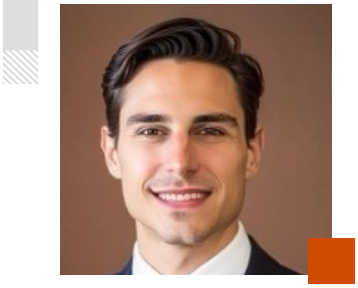

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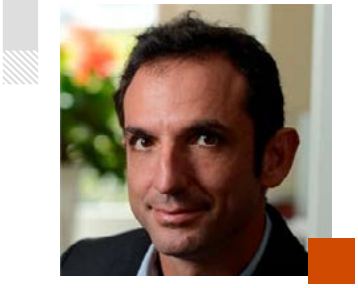

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