Intelligent manufacturing

A blueprint for creating value through AI-driven transformation

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Foreword

Artificial intelligence (AI) is reshaping every facet of manufacturing. From design to production, supply chains to sales, and workforce management, AI is unlocking new efficiencies and enabling smarter, more agile operations. It's also powering sustainability, helping manufacturers minimize waste and optimize energy use.

The potential is vast, but so are the challenges. AI adoption remains fragmented and functionally driven. Many manufacturers are deploying AI in silos — production floors are embracing AI-driven automation and predictive maintenance, while back-office functions remain largely unintegrated and lacking automation. This disjointed approach limits AI's full potential, preventing the industry from achieving true enterprise-wide transformation.

The sector also presents a stark contrast in maturity levels. Smart industrials are leading the charge, embedding AI deeply into their operations. More traditional manufacturers are still experimenting with localized AI use cases, hesitant to commit to full-scale transformation. Meanwhile, agentic AI, the next frontier in intelligent tools, waits in the wings.

By enabling self-optimizing supply chains, autonomous production lines and real-time coordination across business functions, agentic AI paves the way for a truly intelligent, end-to-end manufacturing model. But to fully realize its potential, manufacturers should move beyond isolated AI implementations and embrace a connected, enterprise-wide approach.

This report explores how manufacturing leaders can leverage AI as a transformative force. The future belongs to those who recognize that AI is no longer just about automation. It's about autonomy, intelligence, integration and a new more effective way of working.

> To unlock the full potential of AI, manufacturing companies should move beyond isolated use cases and reimagine how intelligence is embedded across the enterprise. This means aligning AI with strategic value streams, reshaping culture to embrace experimentation and agility, and designing for trust, transparency and scale. The real opportunity lies not just in smarter operations, but in creating a more connected, adaptive and value-driven ecosystem.

Jonathon Gill
Global Head of Industrial Manufacturing
KPMG International

Contents

Introduction

For industrial manufacturers, the Fourth Industrial Revolution (Industry 4.0) demands greater agility and real-time decision-making. AI has become a necessity rather than an option, enabling predictive maintenance, intelligent automation and data-driven optimization. However, intelligent manufacturing is about more than just adopting AI — it's about transforming industrial ecosystems to unlock AI's immense value, drive operational efficiency and resilience, and create new competitive advantages.

For production and supply chains, AI enables real-time decision-making, predictive analytics and self-optimizing workflows. For example, AI can combine external and internal data points, such as client consumption patterns and global indices, to provide a meaningful decision support system around cost optimization. Intelligent tools enhance demand forecasting, inventory management and logistics, by identifying vulnerabilities quickly.

In the workforce, AI and augmented reality help train employees on best practices while automating routine tasks, supporting predictive maintenance and enabling dynamic scheduling. Finally, in the back office, AI streamlines finance, procurement and HR functions — areas that remain largely under-digitized in traditional manufacturing.

KPMG wanted to learn how industrial manufacturers are using AI to reduce costs and expand revenues. To understand this, we surveyed 183 senior manufacturing AI leaders across eight countries. What we discovered is that AI leaders in the sector recognize that embracing AI is no longer optional but a strategic necessity — 93 percent believe that organizations that fully integrate AI will gain a significant competitive edge over those that do not.

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This report is designed to provide manufacturing industry decision-makers with actionable insights and strategic recommendations to navigate the complexities of AI adoption, especially as Industry 5.0 leans on multi-model AI to make this integration human friendly. By integrating AI across functions, manufacturers can unlock enterprise-wide value rather than limiting AI to isolated use cases. To help industrial leaders maximize AI's impact, this report examines:

- How AI can improve efficiency, enhance agility and drive sustainability in manufacturing, while addressing challenges such as fragmented data, legacy systems and workforce transformation
- Findings from a survey of AI leaders across industrial manufacturing, exploring how organizations are approaching AI strategy, investment and implementation
- The characteristics of intelligent manufacturing organizations and how to build them, examining what differentiates AI-ready manufacturers.

We offer an AI maturity model and framework to help organizations progress through three key stages:

- **Enabling workforces and building AI foundations**
  Establishing the data integration, governance and skills necessary for responsible AI adoption
- **Embedding AI across the enterprise**
  Scaling AI solutions beyond production into supply chains, procurement and business operations to drive holistic transformation
- **Evolving operating models and ecosystems**
  Moving toward agentic AI-powered manufacturing that fosters end-to-end connectivity, self-optimizing production systems and AI-driven decision-making across the enterprise.

At a glance

AI is a competitive necessity

93% believe that organizations in their industry that embrace AI will develop a competitive edge over those that do not

72% intend to use AI to improve efficiency, 77 percent to drive growth

AI integration is well advanced

74% are using machine learning and 72 percent predictive analytics, 67 percent are using agentic AI

74% systematically incorporate AI into product and service development

Early results are promising

96% have experienced operational and efficiency improvements

45% have experienced financial improvements, with 62 percent experiencing an ROI of greater than 10 percent

Significant investments are being made

36% say that AI is greater than 10 percent of their total IT budget

77% intend to increase this over the next 12 months, 71 percent by more than 10 percent

Implementation has been challenging

56% have faced data challenges when implementing AI

40% are experiencing workforce issues in terms of skills or resistance to change; in response 80 percent have invested in knowledge and skills training on their AI tools

Risks are being identified and managed

65% have a structured approach to AI risk management, with thorough processes to identify, assess and mitigate risks

Data privacy **(57 percent)** and regulatory compliance **(44 percent)** are the major areas of focus

But sustainability is a concern

78% believe meeting sustainability targets is more important than AI

85% have plans in place to mitigate the increased energy demands of implementing AI technology

Research findings

AI leaders in industrial manufacturing are setting the stage for a new era of intelligent operations, automation and innovation. With strong investment, strategic alignment and a focus on workforce readiness, manufacturers are well-positioned to harness AI's transformative potential. However, balancing technological advancement with sustainability, risk management, and market uncertainty will be key to ensuring long-term success.

AI leadership in industrial manufacturing: A transformational shift

AI leaders in the sector recognize that embracing AI is no longer optional but a strategic necessity — 93 percent believe that organizations that fully integrate AI will gain a significant competitive edge over those that do not.

AI as a core component of business strategy

AI is quickly becoming integral to operations: 20 percent of manufacturers consider AI a core component across all departments. Furthermore, 26 percent have embedded AI into their organizational culture and operations, using it to drive innovation, create new business models and explore untapped markets.

Agile and hybrid organizational models driving AI success

To support AI adoption, manufacturing firms are rethinking their organizational structures. Nineteen percent have adopted an agile approach, where teams are cross-functional, adaptable and focused on specific projects or goals to ensure rapid iteration and delivery. However, 50 percent have implemented a hybrid model, blending multiple approaches such as functional and agile structures to optimize flexibility and efficiency.

Cloud, on-premises and AI-driven data infrastructure

While 60 percent have predominantly cloud-based IT systems, AI adoption remains rooted in both cloud and on-premises infrastructure; in fact, 84 percent are leveraging on-premises AI solutions. The ability to manage and integrate data effectively is also a priority, with 52 percent implementing cross-platform data integration or intelligent data fabrics, and 74 percent making significant use of AI-powered data platforms.

AI maturity and development approaches

The industry is seeing a growing level of AI maturity, with 62 percent having used AI for over three years. Open-source AI tools play a vital role in this ecosystem, with 70 percent making significant or extensive use of them. Eighty-four percent are actively developing AI solutions in-house, demonstrating a commitment to custom AI innovations tailored to industry-specific challenges.

Advanced AI capabilities in manufacturing

AI applications in industrial manufacturing are rapidly expanding. Seventy-four percent of organizations are utilizing machine learning, while 72 percent are leveraging predictive analytics. Process automation is also a key focus, with 67 percent integrating AI with RPA. Notably, 67 percent are using agentic AI, with an additional 20 percent planning to expand its use. Confidence in AI's decision-making capabilities is high: 91 percent are comfortable allowing AI to make end-to-end autonomous decisions for specific processes.

Figure 1: Manufacturing driving operational gains with AI

Percentage who say their organization has achieved the following benefits through using AI

What benefits has your organization had from using AI in the business? (Maximum 5) n=163

Source: Intelligent manufacturing: A blueprint for creating value through AI-driven transformation, KPMG International, 2025

AI's impact on key business functions

AI adoption is having the greatest impact on R&D and IT functions, according to 77 percent of industry leaders. However, its influence extends across the value chain, with 70 percent citing significant operational improvements as AI becomes embedded into core business functions.

Investment trends and budget prioritization

Investment in AI is accelerating, with 36 percent of manufacturers allocating over 10 percent of their total IT budget to AI. Looking ahead, 77 percent plan to increase AI investments over the next year, with 71 percent expecting growth of more than 10 percent. The primary objectives of these investments are clear: 72 percent aim to enhance efficiency, with 52 percent focused on process automation and 77 percent using AI to drive business growth.

Challenges in AI implementation

AI adoption is not without challenges. Fifty-six percent of manufacturers have faced data-related issues when implementing AI solutions, while 40 percent report workforce challenges, including skills gaps and resistance to change.

Measuring AI's business impact

The benefits of AI adoption are already materializing. Ninety-six percent of organizations have reported operational and efficiency gains, while 45 percent have experienced measurable financial improvements. Return on investment (ROI) is a key metric, with 62 percent achieving an ROI greater than 10 percent and 31 percent expecting AI investments to yield a return of over 30 percent in the next 12 months.

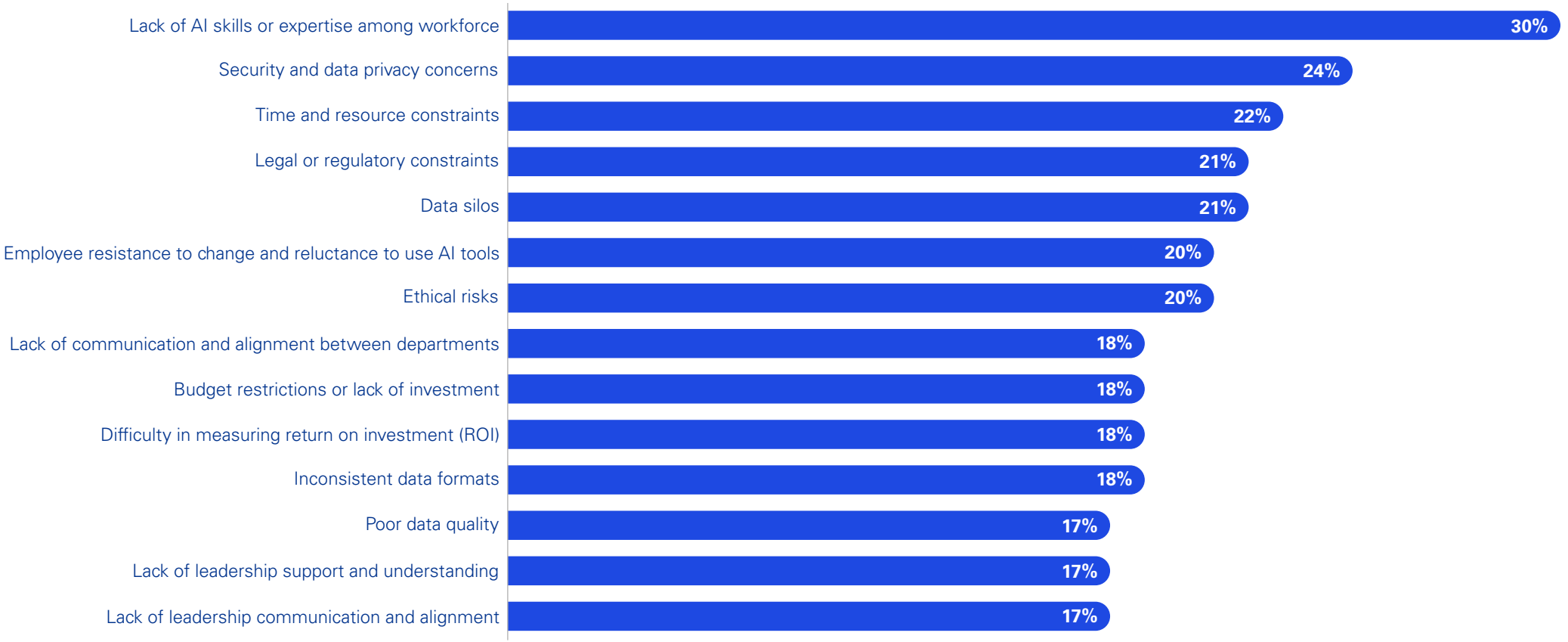
Managing AI risks and ensuring responsible AI deployment

With AI playing a more central role in operations, risk management has become a priority. Sixty-five percent of manufacturers have a structured approach to AI risk management, focusing on areas such as data privacy (57 percent) and regulatory compliance (44 percent). Proactive risk management ensures AI adoption remains responsible, secure, and aligned with industry standards.

of manufacturers have faced data-related issues when implementing AI solutions

Figure 2: Skills gaps are the top hurdle for manufacturing

Percentage who say their organization has faced the following challenges when integrating AI



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AI upskilling and workforce readiness

Workforce preparedness is a critical enabler of AI adoption. Recognizing this, 80 percent of organizations have invested in AI knowledge and skills training, while 72 percent have focused on building a comprehensive business AI strategy. Encouragingly, 89 percent believe employees are quickly adapting to AI tools and technologies, supporting widespread adoption across the workforce.

AI strategy and leadership confidence

AI adoption is no longer a siloed IT initiative — it is a strategic priority. Sixty-eight percent of organizations have a dedicated AI team that leads and shapes AI strategy, ensuring AI solutions are systematically integrated into core business functions. Seventy-four percent have embedded AI into product and service development, making it a central component of their market offerings and customer experience. Importantly, 75 percent of industry leaders trust AI-driven insights and confidently rely on AI for decision-making across multiple business areas.

Balancing AI adoption with sustainability goals

While AI adoption is accelerating, manufacturers are also conscious of its broader implications. Seventy-eight percent believe meeting sustainability targets is more important than AI, highlighting the sector's commitment to responsible innovation. Additionally, 85 percent have strategies in place to mitigate AI's increasing energy demands, ensuring AI adoption aligns with long-term sustainability goals.

Balancing strategic AI investments with market uncertainty

Despite enthusiasm for AI, industrial manufacturers are navigating a rapidly evolving technology landscape. Seventy-six percent believe it is best to wait and observe how AI technologies mature before making large-scale investments. Meanwhile, 67 percent face significant shareholder pressure to demonstrate immediate ROI on AI investments. However, this has not deterred innovation — 72 percent continue to invest in AI experimentation and innovation.

Aligning AI with long-term business strategy

AI adoption in manufacturing is not just about efficiency — it is about long-term growth and transformation. Seventy-nine percent of industry leaders state that their organizations have achieved strategic alignment on AI adoption, with 39 percent fully integrating AI into their five-year growth plans. This structured approach ensures AI investments align with business objectives, paving the way for sustained competitive advantage.

> There is natural embracement of AI technology by the organization, and in Canada, we are going slowly because we don't have the skills and the technical support that India has to support implementation. That's why we are starting with software departments. We don't want to be completely disruptive, but the idea is to go towards all the departments in a gradual manner.

Chief Financial Officer — Canada

Summary key recommendations

To drive AI adoption and long-term value creation in industrial manufacturing, leaders should:

Develop an AI strategy that aligns with core capabilities and maximizes value

Manufacturers should develop a blueprint for implementing AI across the enterprise with a focus on AI applications that have a high business impact and provide immediate operational benefits, such as predictive maintenance, defect detection production optimization and AI-driven supply chain forecasting.

Build trust into the AI transformation roadmap

Trust is essential for enterprise-wide AI adoption. Explainable AI (XAI) models, ethical governance frameworks and clear regulatory compliance measures will help manufacturers create transparency and accountability. Engaging engineers, factory operators, supply chain managers and business leaders early in the AI journey — addressing concerns about workforce impact, data security and decision-making autonomy — will foster long-term confidence.

Create a sustainable technology and data infrastructure

Maximizing value from AI depends on integrated, scalable and secure data infrastructure. Organizations should build a connected data ecosystem that integrates research and development (R&D), production and field service data. Cloud-based AI platforms, intelligent edge computing and cross-platform data fabrics enable real-time AI-driven insights and interoperability across legacy systems and new digital technologies.

Build a workforce culture that elevates human-AI collaboration

AI should augment human expertise, not replace it. Leaders need to think through how processes will change post AI implementations and how humans and AI should work together in a new way. This should be defined for each function. Manufacturers should reskill employees, integrate AI into factory operations and decision-making processes, and create a culture where AI enhances efficiency, safety and innovation. Encouraging cross-functional collaboration between AI specialists, engineers and frontline workers helps ensure that AI adoption uplifts workforces.

The transformative role of agentic autonomous agents

Agentic autonomous AI — AI-driven systems capable of independent reasoning, decision-making and goal-oriented execution — can fundamentally reshape industrial manufacturing. These AI agents can proactively manage complex processes, adapt to changing conditions and collaborate with humans and other systems to drive efficiency, innovation and resilience.

Agentic AI can introduce self-directed, goal-oriented decision-making across various manufacturing processes. Key areas of future transformation include:

Autonomous production lines

- AI agents can optimize production schedules in real time based on demand, resource availability and machine performance.
- Autonomous agents can detect and correct defects proactively, reducing waste and enhancing quality control.
- Self-optimizing robotic systems can collaborate with human workers to enhance efficiency while maintaining flexibility.
- AI agents can track process parameters and adjust other machine parameters to maximize yield to optimize costs and drive consistency.

Self-optimizing supply chains

- AI agents can drive intelligent commodity forecasting by tracking multiple market indices in real time and adjust procurement strategies dynamically to optimize costs and balance risks.
- AI agents can act as intelligent negotiation assistants by triangulating patterns from past supplier negotiations, supplier performance and market indices to derive supplier strategies to effectively drive cost optimization.
- They can also help build resilience by dynamically adjusting inventories in supply chain/ordering patterns based on market fluctuations, weather disruptions or geopolitical shifts.
- They can also optimize the share of business (SOB) processes by identifying cost-saving opportunities, flagging anomalies and streamlining approvals — driving greater efficiency, compliance and value across the procurement value chain.
- Predictive logistics can help anticipate demand changes and reroute shipments to optimize delivery timelines.

Autonomous maintenance and asset management

- AI-driven agents can predict and prevent equipment failures by continuously analyzing sensor data.
- Autonomous systems can schedule and execute maintenance tasks without human intervention, minimizing downtime.
- Digital twins, powered by agentic AI, can simulate wear and tear, testing different maintenance strategies to extend machine lifespan.
- AI agents help in understanding failure patterns of equipment, identify critical spares, redesign spare part policies and release auto purchase orders based on minimum inventory thereby enabling minimum downtime.

Adaptive manufacturing for mass customization

- AI-driven factories can dynamically reconfigure assembly lines based on customer preferences, enabling on-demand, highly personalized production.
- Autonomous design agents can generate customized product blueprints based on specifications provided by customers.
- AI agents can help ensure seamless real-time coordination between engineering, production and logistics.

Human-AI collaboration in decision-making

- AI agents can assist production managers by analyzing complex scenarios and proposing optimized strategies.
- Intelligent copilots can provide real-time recommendations to factory workers on the shop floor, improving decision-making speed and accuracy.
- AI-driven training simulations can provide personalized learning experiences, accelerating workforce upskilling.

Circular economy and sustainable manufacturing

- AI agents can help optimize material usage and recycling efforts by identifying waste reduction opportunities across the production cycle.
- Autonomous systems can track carbon emissions in real time, ensuring compliance with environmental regulations.
- AI-driven energy management systems can dynamically adjust power consumption to help minimize costs and environmental impact.
- AI agents dynamically help optimize run hours of power generating equipment based on demand and help in reducing power consumption by adjusting parameters in the equipment, thereby delivering a broad power management solution.

> “Artificial intelligence evolves faster than the weather changes; new algorithms, tools and frameworks come one after another like waves. This means that companies must continually invest resources in learning and upgrading, much like running an endless marathon. For the technical team, it’s as if we are required not only to run but also to occasionally learn how to ride a bicycle, drive a car and even pilot a spaceship. For the company’s budget, it feels like trying to fill a bottomless pit, but you have no choice but to jump in because falling behind means being left out.”

Chief Financial Officer — China

The data problem in manufacturing

Our research respondents highlighted the difficulties and complexities of data management, inhibiting implementation and frustrating progress. Manufacturing generates vast amounts of data — from R&D labs to the shop floor to field service operations. However, this data is often fragmented, siloed and disconnected, hiding insights and limiting its potential value.

Manufacturers can unlock real value by integrating R&D, production and field service data into a closed-loop system. Without this integration, manufacturers struggle to turn data into actionable insights, missing opportunities for efficiency, innovation and cost reduction.

The disconnect

Each stage of the manufacturing process collects critical but isolated data:

- R&D captures insights from product design, materials testing and simulation models.
- The shop floor generates real-time production data on machine performance, quality control and efficiency metrics.
- Field service teams collect valuable feedback on product failures, performance under real-world conditions and customer usage patterns.

These datasets rarely communicate with each other, meaning lessons learned from real-world product performance fail to inform design improvements, and production inefficiencies persist without feedback loops from R&D and field teams.

The complexity of manufacturing data

Manufacturing data is not just siloed — it is also highly heterogeneous.

- Products vary widely in complexity, requiring different data structures and analytics approaches.
- Ownership of data is fragmented across multiple stakeholders — including manufacturers, customers, distributors, dealers and third-party service providers.
- Data formats and standards vary across different production lines, making integration a technical challenge.
- Without a unified data strategy, manufacturers struggle to extract meaningful insights. They remain reactive rather than predictive, limiting their ability to optimize performance, enhance quality and accelerate innovation.

Solving the data challenge

To help maximize AI's potential, manufacturers should move from disconnected data silos to a fully integrated, AI-powered ecosystem. By creating a closed-loop data framework that connects R&D, production and field service, manufacturers can:

- Continuously optimize product design based on real-world performance.
- Enable predictive maintenance and reduce unplanned downtime.
- Improve supply chain efficiency by aligning production with demand signals from field data.

AI-driven, cross-functional data integration is the key to transforming manufacturing from a reactive industry to a proactive, intelligent ecosystem.

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is the key to transforming manufacturing from a reactive industry to a proactive, intelligent ecosystem.

> The first valuable lesson we learned was the importance of acquiring high-quality data. Initially, dealing with public data or early datasets felt like a nightmare — cleaning and transforming this data was time-consuming and labor-intensive, often yielding unsatisfactory results.

Chief Financial Officer — Germany

How agentic supports business transformation

Agentic AI offers a new approach to integrating, managing and optimizing manufacturing data.

> We need to set up processes to improve data quality because we can have a lot of data. It could be documents, images, videos; it could be basic data. If it's not of good quality, because the processes aren't uniform or because we have too much diversity, then it's going to be very complicated to implement AI, or the scope of implementation is going to be limited. We believe that autonomous agents will make a real difference to this.

Chief Information Officer — France

AI reshapes the business strategy

With AI capability, enterprises could conduct customer service and business partner communications 24 x 7. This brings more potential to the enterprise, transforming it to a round-the-clock enterprise, especially for organizations that are running across multiple zones.

AI optimizes the business model

With AI capabilities, people will focus on the data and business analysis, instead of the process-driven work, which makes the business more data and insight driven.

Creating a closed-loop data system

Agentic AI can act as a continuous feedback loop, dynamically connecting R&D, supply chain, shop floor operations, sales and field service data, improving the customer experience end to end. Instead of waiting for human intervention to analyze and share insights, AI agents can:

- Automatically ingest and analyze product performance data from field service and feed insights to R&D for design improvements
- Identify recurring production issues from shop floor data and recommend immediate adjustments
- Proactively update predictive maintenance models, ensuring machines are serviced before failure based on real-world usage data
- Help in reducing the number of R&D trials by simulating production performance at lab level for new products thereby reducing new product development time and help in seamless technological transfer.

By automating these feedback loops, agentic AI closes the gap between design, production and performance.

Handling heterogeneous data across stakeholders

Manufacturing data is complex due to multiple data owners (e.g. customers, dealers, distributors, and third-party service providers). Agentic AI can:

- Standardize and reconcile data formats from different sources, allowing seamless integration without manual intervention
- Autonomously validate and clean data, ensuring quality and consistency across the supply chain
- Facilitate secure data-sharing protocols between manufacturers and partners while protecting sensitive information, using federated learning and privacy-preserving AI techniques.

Enabling real-time, AI-driven decision-making

By breaking down data silos, agentic AI enables instant decision-making across the enterprise.
It can:

- Dynamically adjust production schedules based on real-time demand signals from field service data
- Optimize supply chains by anticipating disruptions and autonomously rerouting shipments or adjusting procurement
- Self-improve over time, continuously refining its decision-making capabilities based on new data.

Manufacturing data is complex

due to multiple data owners (e.g. customers, dealers, distributors, and third-party service providers).

Building the intelligent manufacturing organization

Manufacturing organizations have steadily modernized their operations through digital platforms, cloud computing and data-driven workflows.

Now, next-generation AI capabilities — particularly agentic AI — are transforming the manufacturing landscape, requiring organizations to rethink how AI drives value across design, production and supply chain ecosystems.

However, this shift is not just about technology — it's about integrating AI strategically across the enterprise. Manufacturers will have to balance innovation with operational resilience, ensuring that AI-driven advancements in automation, predictive analytics and self-optimizing systems are aligned with security, regulatory requirements and workforce evolution.

Successfully implementing AI in manufacturing requires a structured, multi-layered approach, with capability building across enterprise, functional and foundational layers. Establishing a transformation management office is also crucial for aligning AI strategy, value orchestration and project execution across all layers. This office coordinates AI initiatives, standardizes best practices and facilitates cross-functional collaboration, helping ensure AI delivers maximum enterprise-wide value.

Enterprise

This layer orchestrates transformational change, starting with how AI can adjust strategy, business models and key objectives across the enterprise. It defines operating model shifts, workforce evolution, and risks and controls. This layer maps AI transformation initiatives onto a roadmap and runs a transformation office to manage funding, track benefits and adjust priorities dynamically to help maximize value delivery.

Functions

This layer drives AI-enabled transformation across business functions, prioritizing customer-facing value streams and end-to-end enabling processes and workflow. To enhance the flow of value AI applications, agents and robotics are embedded in the workflows. Functional operating model changes are delivered to realize potential benefits.

Foundations

This layer establishes the AI-first technology stack, including infrastructure, cloud and choices on chips. High-quality enterprise data needs to be curated, and diverse models are likely to be deployed to handle domain-specific AI. An increased focus on cybersecurity for AI is needed as well as a plan for other emerging technology, such as quantum.

Path to value

Our survey found that the path to value in AI is uneven across the organization, with innovation in some areas being easier or more worthwhile to pursue than in others. For example, some areas of the same organization will focus on foundational efficiencies (Enable), other functions or value streams may be scaling AI for growth (Embed) and a few may even be exploring transformative opportunities within ecosystems (Evolve).

As manufacturers progress through these three phases, their operating models will shift from fragmented, siloed automation to fully integrated, intelligent manufacturing ecosystems.

Manufacturers will move beyond traditional, rigid production models to self-optimizing, AI-driven operations. AI can analyze real-time factory data, supply chain signals and market demand, dynamically adjusting production schedules, optimizing energy consumption and predicting (and preventing) maintenance failures.

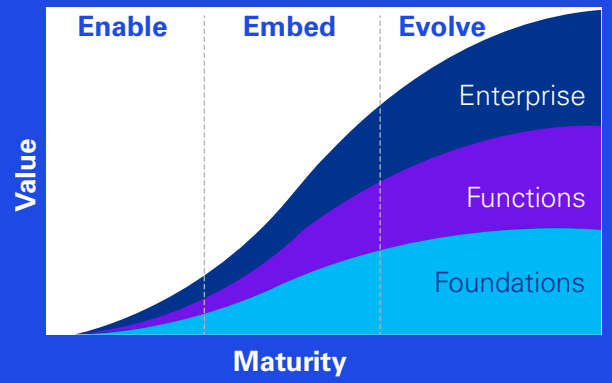
At the same time, manufacturers will likely evolve from isolated production hubs to AI-powered ecosystems, where seamless collaboration between suppliers, distributors and digital platforms enables real-time decision-making. AI can facilitate interoperability across production sites, supply chains and customer demand, ensuring a more agile, responsive and resilient industrial sector.

By bridging data silos, integrating AI-driven intelligence and enabling autonomous manufacturing, AI will likely define the future of efficiency, sustainability and competitive advantage in the industrial sector. The era of intelligent manufacturing has arrived.

The journey to value

Effective AI-enabled transformation goes beyond technology implementation. By examining leading practices, we have identified that organizations can increase capability and value across three phases of AI transformation.

This provides a structured yet flexible framework for navigating the complexities of AI adoption. It balances the need for short-term efficiency gains with the imperative to prepare for future growth and innovation. It helps manufacturers prioritize their efforts, allocate resources effectively, build capability and align their AI initiatives with both short-term goals and long-term strategic objectives.



Enable

The Enable phase focuses on enabling people and building AI foundations. Organizations appoint a responsible executive, create an AI strategy, identify high-value use cases, boost AI literacy, align with regulations and establish ethical guardrails. AI pilots are launched across functions, while cloud platforms and pre-trained models are leveraged with minimal customization.

Embed

The Embed phase integrates AI into workflows, products, services, value streams, robotics and wearables, delivering greater value. A senior leader drives enterprise-wide workforce redesign, reskilling and change, embedding AI into operating models with a focus on ethics, trust and security. AI agents and diverse models are deployed, supported by cloud and legacy tech modernization, while enterprise-wide data enhances operations.

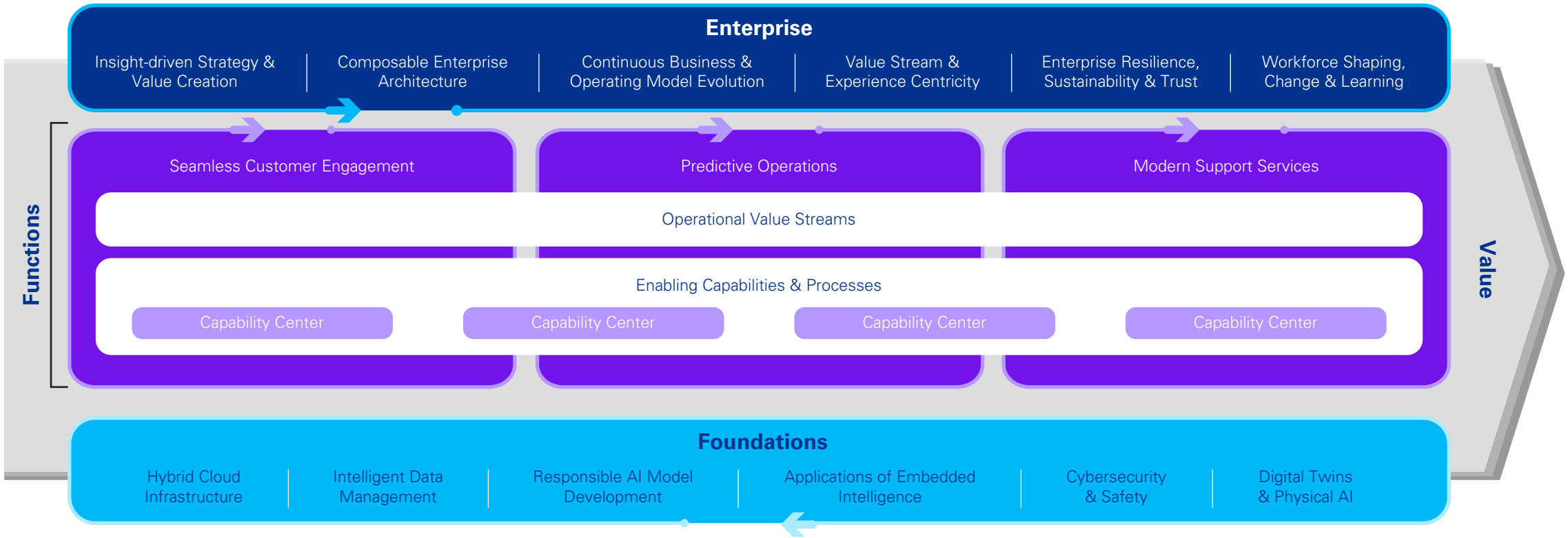
Evolve

The Evolve phase transforms business models and ecosystems, using AI and frontier technologies like quantum computing and blockchain to solve large sector-wide challenges. AI can orchestrate seamless value across enterprises and partners. Emphasizing ethics and trust with real-time security, this phase uplifts human potential with broad and deep workforce training, fostering a creative, innovative and value-driven future.

A company may have a portfolio of initiatives aimed at any level (of the operating model) within each phase. The ratio of effort and investment across the phases will vary as the organization matures. Initially, most resources will focus on phase one, with a small effort to explore enterprise-wide transformation. Over time, as foundational efficiencies are realized, more effort is invested in phase two, while with an eye on the future, long-term investments in phase three start to lay the groundwork for transformative innovation. This dynamic balancing act ensures enterprises can achieve immediate results while setting themselves up in the right way for future success.

Blueprint of an intelligent manufacturer

The blueprint outlines the transformation of an AI-powered, customer-centric enterprise. The intelligent manufacturer leverages advanced technologies, personalized experiences, data-driven insights and automated operations to enhance efficiency, innovation and resilience. Focused on embedding intelligence across value streams, capability centers and processes, it aims to ensure seamless customer interactions, robust risk management, intelligent product manufacturing and future-ready adaptability to thrive in the intelligent economy.



Phases of the AI journey

Focusing on maturity across the Enable, Embed and Evolve phases is critical for sustained value creation. It requires increasing the maturity of the capabilities that are vital to the foundations, functions and enterprise layers simultaneously.

At the enterprise layer, increased AI maturity involves orchestrating AI across functions to enable enterprise-wide innovation and strategic alignment. Without a balanced focus on all three layers, organizations risk missing opportunities for transformation.

At the functions layer, AI should be embedded into key value streams, optimizing specific processes and creating improved outcomes, such as more compelling products and services, and more engaging, end-to-end employee and customer experiences.

At the foundations layer, organizations should build up the new AI-first technology stack, through a process of technology modernization. Infrastructure, data, models and applications can all become optimized for delivery of AI.

	Enable Enable people	Embed Embed AI in work	Evolve Evolve the enterprise
Enterprise	• Define highest-value use cases • Model value opportunities • Deploy in operating model • Initiate early AI guardrails • Invest in AI literacy • Jumpstart an initial program	• Align strategy and OKRs with AI • Define value and investments • Redesign operating model • Strengthen trust in AI • Reshape the workforce • Orchestrate enterprise change	• Define an ecosystem strategy • Model value of the ecosystem • Redesign business model • Always-on AI trust platforms • Extend with partner workforce • Orchestrate ecosystem change
Functions	• Implement functional use cases • Test and learn and refine • Augment people with AI skills • Treat AI as 'co-pilot'/'assistant' • Focus on learning rapidly • Build and deploy in sprints	• Embed AI in value streams • Embed AI in process workflows • Embed AI agents as they mature • Use AI to transform products and experiences • Focus on end-to-end value flow • Undertake agile change	• AI powers ecosystems • AI fuels interorganization workflows • Deploy agents across ecosystems • Evolve new experience possibilities • Focus on end-to-end value outcomes • Continuous, agile change
Foundations	• Select AI strategic alliances • Implement AI applications • Configure and tailor • Introduce simple models first • Access AI through the cloud	• Build an AI development 'factory' • Select and train domain models • Curate enterprise-wide data • Invest in AI infrastructure • Invest in increased cybersecurity	• Deploy AI across ecosystem • Compete using domain models • Compete using ecosystem data • Cloud with AI optimized chips • Consider AI with quantum

The first phase: Enable

Enabling manufacturing teams with AI

The Enable phase equips manufacturing organizations with the foundational capabilities for AI adoption, ensuring that engineers, factory operators, supply chain managers and decision-makers can integrate AI into their flow of work.

At the enterprise level, this includes appointing a senior AI leader, developing a clear AI strategy and aligning AI initiatives with business priorities. Manufacturers must also establish AI literacy programs to train employees — from production teams to corporate leadership — on AI's capabilities, limitations and ethical considerations. They must also remain compliant with industry standards, such as ISO 27001 for AI security, GDPR for data privacy and manufacturing-specific safety regulations.

At the functional level, manufacturers are piloting AI solutions in targeted areas, such as:

- Predictive maintenance to reduce downtime
- AI-driven quality control using computer vision for defect detection
- AI-powered production scheduling to optimize efficiency and reduce waste
- AI-enabled supply chain forecasting to improve inventory management.

At the foundation level, organizations leverage cloud-based AI platforms and pre-trained industrial AI models with minimal customization, allowing them to gain early benefits without extensive infrastructure overhauls. Edge computing and IoT-enabled AI models can also provide real-time shop floor intelligence, improving machine performance and reducing unplanned disruptions.

Early wins: AI as an efficiency driver

The initial focus in AI adoption is to identify areas where AI can deliver immediate, measurable improvements. AI is already proving valuable in:

- Automating production monitoring, reducing the need for manual inspections
- Optimizing supply chain logistics, predicting disruptions and ensuring just-in-time deliveries
- AI-powered defect detection, improving quality assurance and minimizing waste
- Automating administrative tasks such as inventory tracking, procurement and compliance reporting.

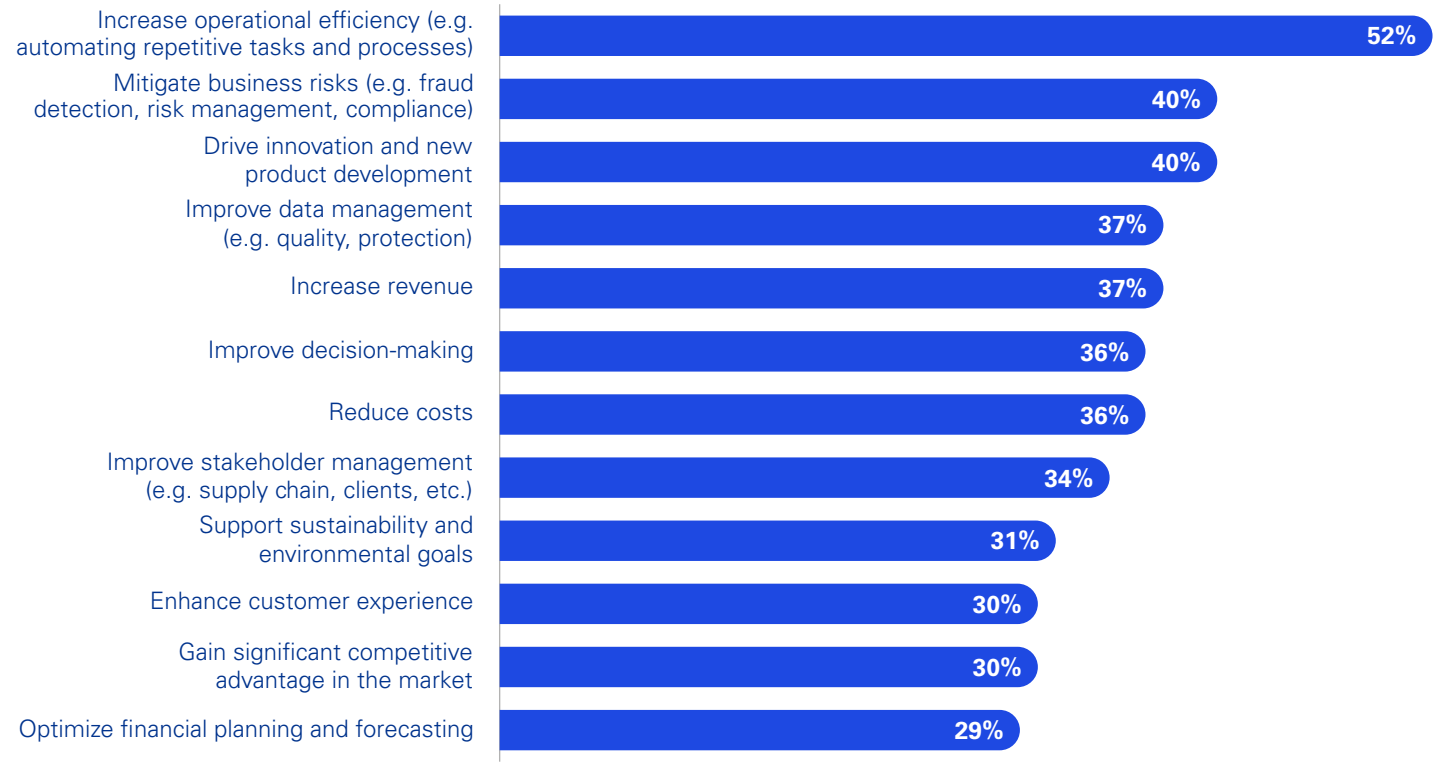
By laying this foundation, manufacturing organizations help ensure that AI adoption is accessible, scalable and strategic, all while delivering tangible business benefits.

> We have more than 200 AI initiatives or projects in place at the moment, spanning across operations, manufacturing, design, creative, sales and marketing, HR, finance, and even more.

Director of AI Strategy — UK

Figure 3: Driving efficiency is a core strategic objective for manufacturing

Percentage who say their organization wants to achieve the following through using AI



Which of the following goals does your organization want to achieve through using AI? (Maximum 5) n=163

Source: Intelligent manufacturing: A blueprint for creating value through AI-driven transformation, KPMG International, 2025

The first phase: Sources of value

By harnessing AI's capabilities, manufacturers can lower costs, improve quality and remain competitive against low-cost producers, all while increasing agility and resilience.

Higher productivity and cost reduction: Competing on a global scale

Manufacturing is a cost-driven industry, and AI offers increased productivity and reduced operational expenses — especially important in high-cost regions where it's difficult to remain competitive against low-cost producers. AI-powered automation and self-optimizing production lines can streamline workflows, minimize idle time and improve throughput, ensuring maximum utilization of equipment and labor.

Improving efficiency beyond the production floor

AI's impact on non-production functions is just as profound. Back-office automation can streamline administrative tasks such as procurement, finance, compliance reporting and workforce management. AI-powered supply chain intelligence can enhance demand forecasting, procurement decisions and supplier negotiations, smoothing operations and freeing up capital.

Reducing defects and warranty claims

Quality control is a major cost center in manufacturing. AI-driven computer vision and machine learning algorithms can detect microscopic defects in real time, preventing faulty products from leaving the production line. This can reduce warranty costs and minimize capital tied up in rework.

Predictive maintenance: Maximizing equipment uptime

Unexpected equipment failures can result in huge financial losses and supply chain disruptions. AI-driven predictive maintenance addresses this by continuously monitoring machine health, analyzing sensor data and predicting failures before they occur.

Enhancing decision-making across the enterprise

AI enables leaders to make data-driven choices with greater confidence. AI-powered real-time analytics, scenario modeling and risk assessment tools allow manufacturers to anticipate market shifts, supply chain disruptions and operational bottlenecks. With AI-driven dashboards and intelligent assistants, executives gain instant insights into key performance metrics, enabling rapid responses to changing conditions.

AI-powered price forecasting for raw materials

Volatility in raw material prices poses a significant challenge for manufacturers. AI-powered price forecasting models analyze historical data, market trends, geopolitical events and real-time supply-demand dynamics to predict future price movements with high accuracy. This allows procurement teams to negotiate better contracts, hedge against price fluctuations and make smarter purchasing decisions, with the ultimate goal of reducing cost volatility and improving profitability.

AI-enabled execution support and business allocation

Manufacturers often struggle with allocating production across multiple facilities, suppliers and distribution networks. AI-powered execution support systems dynamically adjust business allocation strategies based on real-time demand, production capacity and logistical considerations. AI-driven supplier and partner performance tracking helps manufacturers optimize relationships and shift workloads efficiently.

To guide clients' AI strategy and investments, KPMG in the US recently concluded an 18-month research project — *Quantifying the GenAI opportunity*. The research evaluated the realistic value at stake from fully deploying and adopting Gen AI.

Over

17 million companies globally were assessed.

After looking in depth at

7,000 companies employing

72 million people and pressure-testing results with

500 clients,

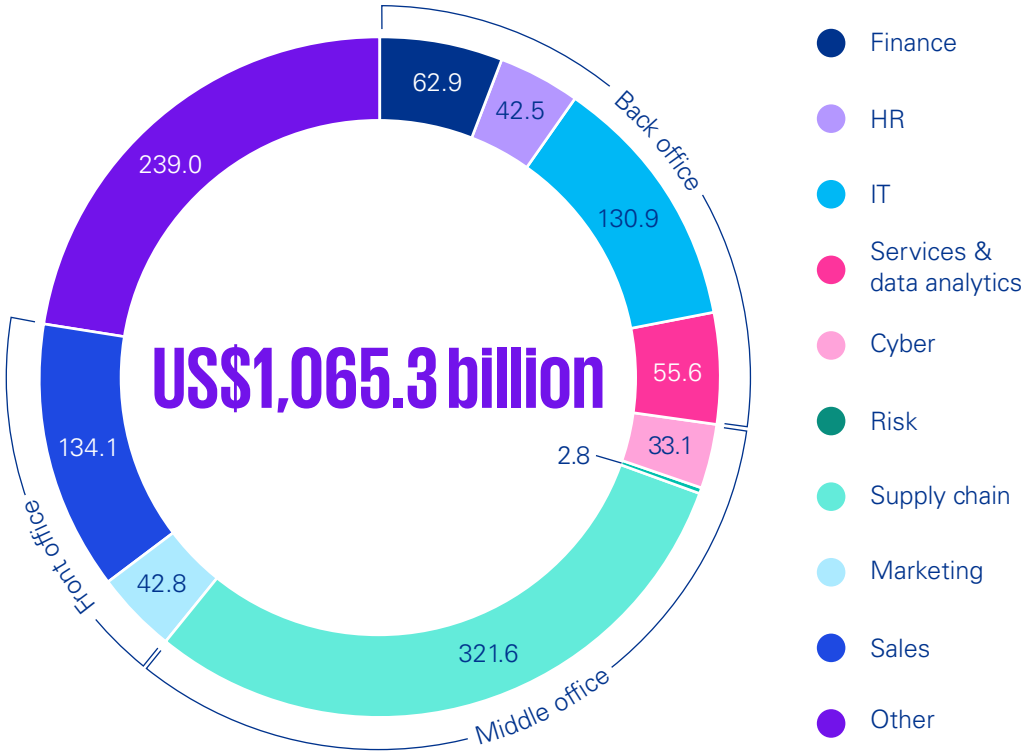
the results conservatively equate to

4–18% EBITDA* improvement in labor productivity alone.

The following chart reveals the potential value at stake within the manufacturing sector.

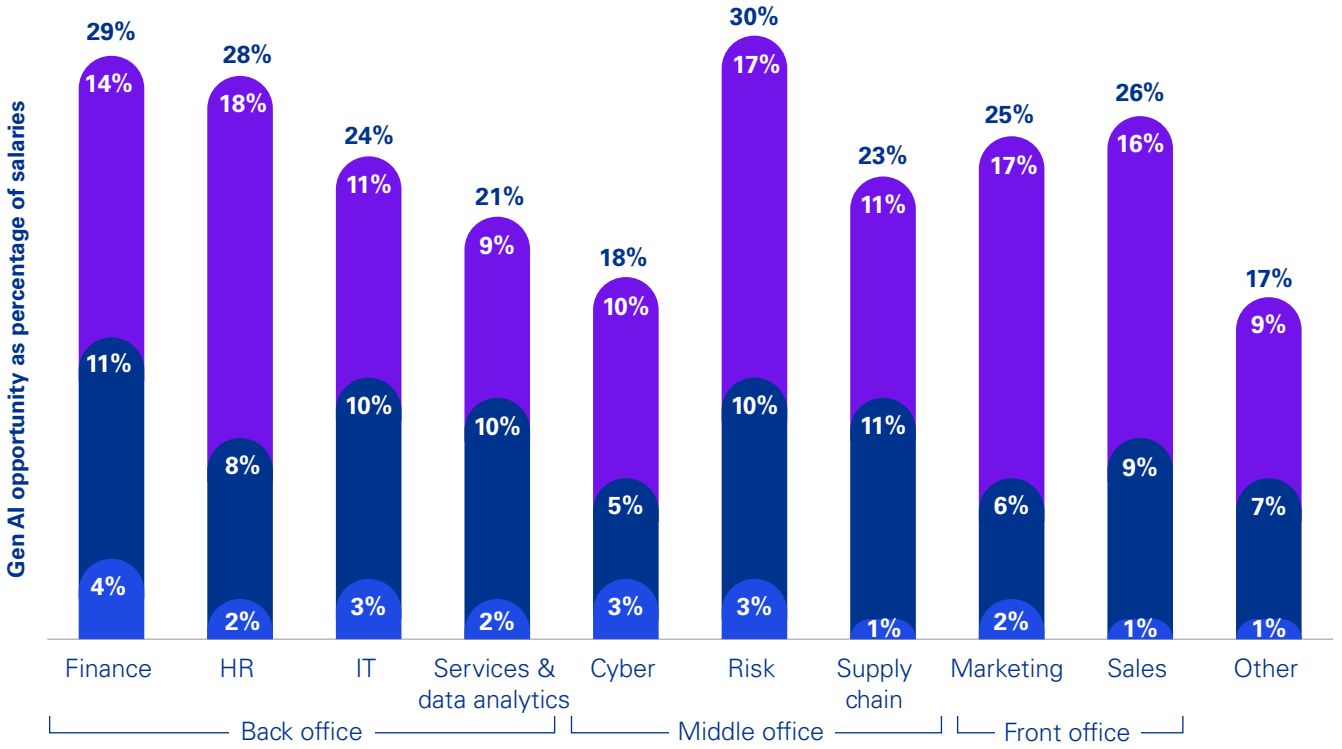
*EBITDA = Earnings before interest, taxes, depreciation and amortization

Figure 4a: Gen AI opportunity by function: Manufacturing (Value in US$ billions)



Source: Quantifying the GenAI opportunity, KPMG in the US, February 2025

Figure 4b: Gen AI opportunity, task complexity breakdown: Manufacturing



Low complexity

Based on tasks that are relatively simple and can be effectively augmented using readily available Gen AI tools such as Copilot, ChatGPT and other out-of-the-box technologies.

Medium complexity

Based on tasks that have potential for Gen AI augmentation but may necessitate the development of more integrated and customized solutions.

High complexity

Based on tasks that have potential for Gen AI augmentation but will likely require the creation of integrated and sophisticated solutions, as well as comprehensive governance and change management to enable adoption.

Note: Figure 4b shows the Gen AI opportunity as a share of total salary cost by degree of complexity within each function for all manufacturing companies in the sample. The axis represents share of the Gen AI opportunity as a proportion of the total salary cost by degree of complexity within the function. Percentages in the graph were rounded to the nearest whole number.

Source: Quantifying the GenAI opportunity, KPMG in the US, February 2025

Top areas of opportunity: Manufacturing

01 Operations execution

02 Customer relationship management

03 Performance optimization

04 Supply chain resource allocation

05 Maintenance execution

06 In-store analytics

07 Customer sentiment analysis

08 Supply market risk

09 Sales enablement

10 Product development

Source: Quantifying the GenAI opportunity, KPMG in the US, February 2025

Case study

Leveraging AI for manufacturing excellence

The head of AI/ML at a UK-based consumer products company, shared insights on how the company is using AI to modernize its traditionally manual industry.

Current AI usage

Using AI for operational excellence in manufacturing

The company embarked on its AI journey through a Knowledge Transfer Partnership (KTP) with a university, due to a lack of internal expertise in AI. This initial collaboration paved the way for other partnerships with multiple universities across the UK to further advance AI implementation.

One key use case of AI is weight optimization in production, where AI predicts and balances weight, minimizing excess giveaways and improving cost efficiency. Additionally, computer vision and autonomous mobile robots are being integrated into factory operations to enhance efficiency and streamline production processes.

Other applications of AI include AI-powered digital twins to create virtual models of machinery for predictive maintenance, to anticipate potential equipment failures and allocate resources effectively.

Challenges

Overcoming difficulties around AI acceptance and talent acquisition

One challenge faced by the organization is gaining acceptance around AI with the workforce, in part due to employees' concerns about job security. Additionally, encouraging subject matter experts to openly share their industry knowledge for the development of pioneering AI systems — crucial for preserving specialized expertise in cheese production — has proven difficult.

Another challenge is the difficulty of attracting AI talent to the rural area where the company is based in the UK, which limits access to skilled professionals needed for further AI development.

Organization's AI outlook

The importance of transforming operational processes to fit AI

The respondent acknowledges the need to transform operational processes in their manufacturing plants to better fit AI into operations. Moreover, the respondent shared that AI strategy will no longer be confined to IT teams and that it will become a core business strategy, requiring involvement from all teams across the organization.

The second phase: Embed

Embedding AI in the flow of work

The Embed phase marks the shift to fully integrated, AI-driven manufacturing ecosystems. While some processes may still be in the early phases of AI adoption, manufacturers in the Embed phase begin to unlock AI's true value beyond cost savings.

At this stage, AI is embedded into end-to-end workflows, industrial robotics, digital twins and production control systems. A senior AI leader oversees enterprise-wide transformation to align AI with strategic business goals. This phase also emphasizes safety, security and trust.

AI models — ranging from small, task-specific algorithms to large, autonomous agentic systems — are integrated into manufacturing execution systems (MES). A hybrid infrastructure combining cloud computing, edge AI and on-premises GPUs helps ensure scalability, security and seamless data processing.

As AI becomes more deeply embedded in core manufacturing functions, traditional product-centric operating models are being redesigned. This transformation shifts the focus from linear, rigid production workflows to dynamic, AI-powered value streams. In this way, manufacturers 'future-proof' their businesses, unlock new revenue opportunities and establish themselves as leaders in the next era of intelligent industrial manufacturing.

> "In our design department, we have specific KPIs that we've been measuring; we were able to be 67 percent more efficient with our time. For other departments, [the value of AI is] not so clear."
>
> **Chief Technology Office** — Japan

Key value streams in manufacturing

As manufacturers move through the Embed phase, AI is integrated across end-to-end value streams. This helps improve efficiency and promote revenue growth. AI enables more automation, higher throughput driving larger production fulfillment and more revenue.

These key value streams represent areas where AI can deliver transformative impact:

Intelligent production and automation: AI-driven MES deliver dynamic production scheduling while reducing downtime and improving yield, creating self-optimizing factories that adapt to real-time conditions.

Intelligent products: The creation of smart, intelligent products and services delivering ongoing value to customers by combining advanced technology, data insights and personalized experiences that enhance outcomes, efficiency and satisfaction.

Smart sales: AI-supported sales value stream using intelligent customer insights and real-time analytics to tailor energy solutions, enabling personalized offers, targeted upselling and greater customer conversion — ultimately driving higher revenue and deeper engagement.

AI-driven supply chain and logistics: AI-powered supplier risk assessment, autonomous freight management and smart warehouse operations improve cost efficiency, speed and responsiveness.

AI-enabled product and process innovation: By analyzing performance data from R&D, production and field operations, AI closes the design-feedback loop, enabling faster prototyping, reduced material waste and next-gen product development.

Connected customer experience and aftermarket services: Manufacturers use machine learning to recommend upgrades and optimize service contracts, shifting from one-time sales models to AI-powered product-as-a-service offerings.

Sustainable and circular manufacturing: AI-powered carbon footprint tracking, energy optimization and waste recycling analytics help manufacturers meet sustainability goals and reduce costs simultaneously.

Intelligent commodity forecasting: Based on market trends, AI can suggest the right strategy to be taken for a commodity in terms of buy early and buy more during increasing trend of the commodity or buy less and buy late during the decreasing trend.

Barriers to progress in the second phase

Several challenges may slow down the progress of value stream transformation during the Embed phase.

- ## Manufacturing companies and their systems are highly siloed

  Production, supply chain, R&D and aftermarket services often operate independently. This lack of integration makes it difficult to connect AI-driven insights across the enterprise, limiting cross-functional collaboration and value creation. Many manufacturers still rely on outdated ERP, MES and SCADA systems, making AI adoption costly and complex. Technical debt — outdated infrastructure, disconnected databases, and proprietary legacy software — prevents seamless AI integration, requiring significant modernization efforts.

- ## AI requires data from the entire product lifecycle

  AI's real power comes from aggregating and analyzing data across the entire product lifecycle. However, when data is scattered across multiple legacy systems, ERPs, supplier portals and service platforms, that creates interoperability and data integration challenges. Inconsistent data governance, a lack of real-time data pipelines and multiple data ownership models make building reliable AI models difficult.

- ## Companies struggle to embed AI into products and connect with services

  Many manufacturers struggle to integrate AI directly into their products. This lack of integration limits AI's ability to enhance aftermarket services, optimize performance and drive new business models.

- ## Workforce concerns

  The integration of advanced AI and robotics in manufacturing brings Wa natural apprehension among workers. AI might be considered as replacing human roles. Especially, when it comes to human-to-humanoid robot interaction, companies might face resistance when working in more human machine integrated processes.

- ## Change management is a challenge

  While executive leadership recognizes the need for an end-to-end AI strategy, many mid-level managers and functional leaders resist AI-driven change. In larger manufacturing enterprises, scaling AI across multiple plants, global supply chains and distributed teams creates a massive change management challenge. AI-driven transformation requires new ways of working, which are harder to implement in deeply entrenched organizations.

- ## AI trust, explainability and compliance risks

  Many manufacturers hesitate to automate decision-making with AI due to concerns over trust, explainability and compliance with industry regulations. Building explainable AI models that meet compliance requirements without creating unnecessary bottlenecks is critical.

Case study

Scaling AI across the enterprise

A Chief Information Officer of a manufacturing company in China offered insights into their organization's AI journey.

Current AI usage

Phased AI rollout that is focused on high-value use cases

The manufacturing company is in the early stages of AI adoption, using a phased, small-scale approach by prioritizing resources where AI can create the most value. The respondent shared that AI was first introduced for quality inspection to detect product defects — with AI being judged to do this more accurately and efficiently than manual inspections. The company then applied AI to predictive maintenance, allowing for real-time equipment monitoring to extend machinery lifespan. The respondent shared that AI is also used in the production department, for real-time data analysis and predictive quality control, and in the research and development (R&D) department for analyzing data on new products and supporting with future innovations.

Navigating implementation challenges in data governance, system interoperability, AI implementation costs, talent acquisition and the evolving AI technology

The organization faces several challenges in its AI adoption, including data quality issues, siloed information, and the need for cross-departmental collaboration to achieve effective AI integration. The company also reported issues with system interoperability when integrating AI into their existing infrastructure, as well as concerns over cybersecurity risks due to the reliance of AI systems on network connectivity.

Additionally, cost remains a major barrier, as high initial investment is required for advanced computing infrastructure, scalable storage solutions, and customized AI applications designed for specific industrial operations and production processes. The company also highlighted difficulties in attracting talent that understands both AI and the industrial manufacturing industry, as well as the need to stay up to date with rapidly evolving AI technologies to remain competitive.

Unique challenges facing industrial manufacturing

Environmental pollution and equipment maintenance

The respondent shared that the industrial manufacturing sector faces unique challenges relative to other sectors, including strict environmental standards in production processes around waste and optimizing production flows and equipment, reducing waste emissions and energy consumption.

The third phase: Evolve

Evolving your ecosystem

The Evolve phase transforms enterprises so they can solve larger, industry-wide problems. Companies establish ecosystems with customers, suppliers and governments, orchestrated by AI to deliver seamless value. As costs come down, existing markets will grow, and new ones will emerge.

> The third phase gives the biggest payoff. As AI enables costs to come down, some markets will grow, some decline and new ones emerge. Invest in areas of price elasticity — things we can do more of with AI as costs decline. Your competitors may focus more on what is disappearing and risk being replaced.”

Erik Brynjolfsson — Professor and Senior Fellow at the Stanford Institute for Human-Centered AI (HAI), Director of the Stanford Digital Economy Lab

AI integrates with frontier technologies like advanced visualization, driving breakthroughs in products and services and in close collaboration with customers, key alliances and partners. Ethics, safety and trust are paramount, with real-time monitoring and security updates ensuring platform integrity. This phase emphasizes uplifting human potential, improving experiences and providing robust training and support to help the workforce transition into a creative, imaginative future of value creation and collaboration. In the third phase, organizations use predictive insights to continuously optimize for better, more sustainable outcomes. AI agents, no longer inhibited by silos and organized along value streams, can enable embedded intelligence in core processes, improving customer experiences and product value.

The third phase manufacturer

As manufacturers evolve into ecosystem orchestrators, AI can play a central role in creating intelligent, self-optimizing networks that seamlessly connect suppliers, customers, logistics providers and industry partners. These AI-driven ecosystems can redefine how manufacturing operates, shifting from linear, siloed production models to agile, predictive and collaborative networks that maximize efficiency, sustainability and innovation.

Some companies are already evolving towards this end state. For example, a global consumer goods manufacturer in the UK has integrated AI across various operations, notably in supplier discovery. The company employs AI-driven tools to automatically generate lists of potential suppliers by analyzing online data, assessing attributes such as diversity certifications and financial health. This approach enhances supply chain agility and resilience. Facing challenges in sourcing suppliers for photovoltaic systems due to regulatory changes, a global leader in energy technology turned to AI-powered supplier discovery. Within four weeks, the AI solution identified 59 new suppliers across 12 countries, streamlining the onboarding process and demonstrating AI's capability to rapidly optimize supplier networks.

How leading companies use AI for efficient supplier discovery

In the future, circular manufacturing networks will likely emerge, where AI and blockchain enable real-time tracking of materials across the entire supply chain. Rather than viewing products as single-use assets, manufacturers may use AI to automate the recovery and repurposing of materials, designing products with recyclability and sustainability in mind. AI-powered systems can analyze field data, repair patterns and end-of-life product usage, dynamically adjusting product designs to extend longevity and minimize waste. Manufacturers will likely work with multiple industry partners to efficiently redirect unused materials and outdated components into new production cycles, creating closed-loop manufacturing ecosystems that drastically reduce waste and environmental impact.

Meanwhile, autonomous, AI-driven supply chain ecosystems may make traditional, rigid supply chains a thing of the past. AI agents can predict demand fluctuations in real time, continuously analyzing market trends, geopolitical events and production capacity to optimize global sourcing strategies. Warehouses can operate as self-regulating fulfillment centers, where AI directs autonomous robots, drones and self-driving trucks to manage real-time inventory allocation. AI-powered multi-enterprise platforms will likely negotiate supplier contracts, predict shortages and dynamically adjust supply routes, helping establish resilient, disruption-proof operations. Instead of manufacturers reacting to supply chain disruptions, AI can proactively anticipate risks and self-correct inefficiencies across the entire network.

AI can also enable manufacturers to transition from selling standalone products to delivering "Product-as-a-Service" (PaaS) models. In PaaS, customers pay based on usage, uptime or optimized performance rather than outright purchases. AI-driven digital twins can continuously monitor product performance in the field, allowing manufacturers to remotely adjust parameters, predict failures and provide proactive servicing. AI can help ensure continuous optimization of machinery, allowing customers to maximize operational efficiency while reducing downtime. This shift may fundamentally change how manufacturers interact with customers, transforming their role from product suppliers to long-term service partners.

Finally, manufacturing will likely extend beyond the factory floor, integrating AI-powered infrastructure into cross-industry collaborations. Smart factories can coordinate with energy providers, urban planners and logistics hubs to create fully optimized industrial networks. AI-driven energy management systems can autonomously regulate factory power consumption, adjusting usage based on grid demand and renewable energy availability. Industrial hubs may no longer operate in isolation but can be intelligently interconnected with transportation, logistics and smart city infrastructure. AI can help seamlessly balance production schedules with real-time delivery conditions, optimizing freight routes, warehouse capacity and supplier logistics in real time.

Key considerations

To maximize value creation, manufacturers should align AI efforts with core operational strengths in a way that fosters trust, builds sustainable infrastructure and empowers the workforce.

1 Design an AI strategy that aligns with core competencies and unlocks value

Manufacturers should develop an AI strategy that aligns with their production, supply chain and operational strengths. AI initiatives should be value-driven, targeting areas like predictive maintenance, intelligent automation and supply chain resilience.

> Leaders must also be change agents, guiding their teams through the transformations brought about by AI, while serving as guardians of ethics and compliance to ensure AI is used responsibly and securely.”

Chief Technology Officer — Japan

Key actions

- Prioritize high-impact AI use cases — Focus on AI applications that provide immediate operational benefits, such as predictive maintenance, defect detection production optimization and AI-driven supply chain forecasting.
- Develop an AI governance and leadership framework — Establish a cross-functional AI steering committee, including manufacturing engineers, IT leaders, data scientists and supply chain managers to oversee strategy, ethics and implementation.
- Ensure AI scalability and interoperability — Design AI solutions that integrate seamlessly with existing MES, ERP, and industrial IoT systems, ensuring AI scales effectively across plants, production lines and business functions.
- Define clear AI metrics and ROI measurement — Set quantifiable goals (e.g. reduced downtime, defect reduction, improved inventory accuracy) to help ensure AI delivers tangible value and justifies continued investment.

2 Build trust into the AI transformation roadmap

Trust is critical for AI adoption in manufacturing. Companies must implement XAI, ensure AI-driven decision-making is auditable and interpretable, and engage workers and stakeholders early to foster confidence in AI-enabled automation.

> Cybersecurity has always been a well-trodden topic. For us, while it may not be an insurmountable challenge, the fact that AI systems need to be connected to the network is akin to sending out an invitation to hackers. They might attempt to steal data, disrupt production processes, or even implant malicious code. In manufacturing, AI systems are directly linked to production lines, and if attacked, it could result in equipment failures, production halts, or even safety incidents.

Chief Financial Officer — Canada

Key actions

- Implement XAI and bias audits — Ensure AI models provide interpretable decision-making processes, conduct bias detection and fairness audits, and offer clear insights to engineers, factory workers and leadership.
- Engage engineers, operators and supply chain teams in AI development — Involve shop floor teams, production planners and procurement managers in AI training, feedback loops and co-designing AI-driven workflows to enhance adoption and trust.
- Establish AI ethics and compliance oversight — Develop AI governance frameworks aligned with industry standards such as ISO 27001 (security), GDPR (data privacy) and industrial safety regulations to ensure responsible AI adoption.
- Incorporate continuous testing and feedback loop for AI models to drive accuracy and trust in AI output. AI functionality that is reliable, accurate and trustworthy has a higher degree of success and acceptance.
- Showcase proven AI success stories — Foster confidence in AI adoption by sharing real-world case studies demonstrating how AI has improved efficiency, reduced costs and enhanced quality control.

3 Create sustainable technology and data infrastructure for AI adoption

AI success in manufacturing depends on a scalable, interoperable and secure infrastructure. Companies must modernize legacy systems, unify fragmented data sources and enable real-time AI integration to support intelligent decision-making and automation.

> I believe that compatibility between new and old facilities is a common challenge for manufacturing enterprises undergoing intelligent transformation. Traditional equipment uses outdated communication protocols, while new smart devices use modern IoT [Internet of Things] protocols. This makes communication between them extremely difficult. Moreover, traditional equipment often cannot connect to high-speed networks since AI applications require high-speed connectivity. This network limitation makes data transmission as slow as a snail, impacting real-time monitoring and decision-making.

Chief Information Officer — China

Key actions

- Modernize legacy systems for AI readiness — Transition from outdated, siloed IT systems to cloud-based architectures that support real-time analytics, automation and machine learning models.
- Unify and standardize data across platforms — Implement interoperable data standards and industrial data lakes to integrate inputs from sensors, MES, supply chain platforms and customer feedback systems.
- Invest in secure AI-driven data governance — Use AI-powered data management tools to help ensure data integrity, standardization and security, while automating privacy and compliance measures.
- Adopt edge AI and industrial IoT for real-time AI processing — Process data at the source, enabling real-time defect detection, machine learning-driven optimization and predictive maintenance.

4 Build a workforce culture that uses AI to augment human potential

AI should enhance, not replace, human expertise. Organizations must foster a collaborative AI culture, reskill employees and demonstrate AI's role in improving productivity, safety and decision-making.

> The real challenge is the talent gap — particularly the scarcity of professionals with a composite background who possess both AI expertise and industry-specific knowledge. These multifaceted talents are essential for effectively merging AI technologies with practical applications, thereby generating substantial value. Their ability to bridge technical know-how with industry insights makes them invaluable in driving innovation and ensuring successful AI implementation.

Chief Information Officer — Germany

Key actions

- Integrate AI training into workforce development programs — Ensure AI literacy is embedded in engineering, operations and supply chain training, preparing employees to work alongside AI-powered automation and decision-support systems.
- Reskill and upskill manufacturing professionals — Provide AI competency training for leaders, factory workers, engineers and supply chain teams, equipping them with the skills to effectively collaborate with AI-driven systems.
- Position AI as an enabler, not a replacement — Communicate AI's role in enhancing productivity, reducing repetitive tasks and improving operational efficiency.
- Encourage cross-disciplinary collaboration — Foster partnerships between manufacturing engineers, AI specialists and data scientists to co-create AI solutions that align with real-world factory needs.

Conclusion

Manufacturing's intelligent future

The manufacturing sector stands at the cusp of an AI-powered transformation that will redefine how value is created — from product design and production to supply chains, maintenance, and customer relationships. What was once a primarily physical industry is now becoming deeply digital, driven by intelligent automation, predictive analytics and increasingly autonomous systems.

Our research shows that leading manufacturers are not just experimenting with AI — they are embedding it across core operations to boost productivity, enhance resilience and unlock new revenue streams. AI is improving forecast accuracy, optimizing maintenance schedules, reducing waste and even driving innovation in product development. And as generative and agentic AI evolve, the frontier is expanding — towards systems that can simulate production changes, adapt in real time and drive autonomous decision-making on the factory floor.

Yet, barriers remain. Legacy infrastructure, siloed data, skills shortages and a lack of strategic alignment are preventing many organizations from scaling beyond pilots. Manufacturers that succeed will likely be those that rethink their operating models — integrating AI across value streams, building agile cross-functional teams, and investing in the right partnerships and talent to drive change.

AI is no longer a future consideration; it is a present-day imperative. But its value can not be realized through isolated deployments or incremental improvements. It requires enterprise-wide coordination, and a clear focus on business outcomes. Manufacturers that embrace this mindset can not only drive efficiency — but they can also become more responsive, more innovative and more competitive.

As we look to 2030, the most successful manufacturers will be those that fuse human ingenuity with machine intelligence — creating organizations that are not just automated, but truly intelligent.

Methodology

To gain a broad understanding of how leaders are navigating the opportunities and challenges of implementing AI, KPMG International conducted a robust research program involving multiple methodologies.

This included in-depth interviews with eight AI experts spanning technology, government regulation and industry, as well as discussions with sector-specific KPMG specialists. Qualitative research was conducted to uncover nuanced, industry-specific challenges and opportunities, including insights from several industry experts, including Erik Brynjolfsson of Stanford University, a renowned authority on AI and digital transformation.

The research was further strengthened by a quantitative survey of 1,390 decision-makers across key global markets, including 163 respondents from the manufacturing sector. These leaders shared their experiences and perspectives on overcoming barriers to AI adoption, from dismantling legacy systems to addressing organizational inertia. In parallel, an 18-month research project evaluated the realistic value at stake for fully deploying and adopting generative AI. Together, these inputs offer a clear roadmap for organizations to unlock AI's potential and drive meaningful, enterprise-wide change.

The research was further strengthened by a quantitative survey of

1,390

decision-makers across key global markets, including 163 respondents from the manufacturing sector.

KPMG: Guiding your AI transformation with experience

With over 150 years of experience in data, industry insights, technology and regulatory expertise, KPMG is uniquely positioned to help you uncover AI opportunities, work through critical business challenges and unlock new revenue streams. From strategy to implementation, we guide you in taking small, impactful steps to tackle even the most complex problems — all underpinned by trust.

We've invested in an AI-enabled platform for organizational change. It brings together the best of our thinking, frameworks, strategies and tools. So, you can change smarter and move faster — eliminating inefficiencies and building trust and confidence at every step.

Wherever you are on your AI journey, KPMG can help:

Develop a transformational AI strategy

Define your AI goals, identify opportunities and risks, and create a tailored strategy and execution plan. Build a business case with clear metrics to secure investments and ensure measurable success by scaling AI for enterprise-wide impact and building lasting capabilities.

Ensure AI trust and compliance

Scaling AI introduces complexities and risks. KPMG Trusted AI teams can help ensure your AI solutions are ethical, secure and compliant. Our Trusted AI Framework, built on 10 ethical pillars, empowers organizations to boldly deploy AI responsibly, transparently and with confidence.

Empower your workforce with AI

KPMG AI-enabled workforce solutions deliver personalized adoption and upskilling experiences, helping your team embrace generative AI and infuse it into everyday work.

Build a sustainable AI technology infrastructure

Leverage KPMG professionals' experience to integrate AI frameworks, platforms and accelerators, helping you ensure your technology infrastructure is ready to scale AI initiatives.

We help clients harness the power and potential of AI. From strategy to implementation. Small steps towards solving seemingly impenetrable problems. Underpinned by trust.

You can discover endless opportunities with AI. You can with KPMG.

About the authors

Martin Kaestner
Technology Leader
Industrial Manufacturing
KPMG in the US

Martin manages the execution of data and analytics projects and is particularly focused on applying artificial intelligence and advanced analytics to complex business problems to drive business value. With over 18 years of business and system consulting experience, he assists clients in leveraging technology and analytics to gain tangible business improvements. Martin delivers comprehensive approaches to implement business strategies, manage risk, reduce costs, improve efficiencies and comply with regulations by effectively turning data and analytics into business value.

Carmelo Mariano
EMA Head of Industrial Manufacturing
KPMG in Italy

Carmelo has over 20 years of experience in business consulting and technology advisory. Currently, he serves as the EMA Region Head of the Industrial Manufacturing sector, where he is responsible for strengthening the KPMG brand through strategic collaborations and outreach. He focuses on developing industry-leading services, thought leadership and market strategies to support the largest industrial manufacturers in the EMA region. As the AI Practice Leader for KPMG in Italy, Carmelo helps clients leverage digital technologies and AI to enhance and streamline their operations. His recent projects include supporting large-scale transformation programs and advising clients on creating value through IoT, Digital Manufacturing Solutions, Augmented Reality, Data & Analytics and Intelligent Automation.

S Sathish
Partner and National Sector Leader
Industrial Manufacturing
KPMG in India

S Sathish brings over 27 years of expertise in enhancing EBITDA for clients through various solutions, including procurement cost reduction, digital manufacturing, artificial intelligence, supply chain transformation, operational transformation and sales enhancement. He leads KPMG in India's Industrial Manufacturing sector and serves on the Global Steering Board. Throughout his career, he has collaborated with over 100 clients across diverse sectors, such as automotive, industrial products, paper, cement, textiles, and emerging industries like solar and wind. His experience also includes driving transformations in numerous promoter-driven businesses, making him a seasoned leader in the industrial sector.

Adrian Clamp
Global Head of Connected Enterprise
KPMG International

Adrian Clamp is the Global Head of Connected Enterprise, KPMG's customer-centric, agile approach to digital transformation, tailored by sector. He has over 30 years of experience in leading complex technology change. He specializes in leading large-scale digital transformation programs, deploying new advanced technologies, including AI, to unlock value within large complex organizations. Adrian is a member of KPMG's global consulting leadership team and Global AI Council. He is dedicated to helping to deliver technology-enabled innovation and new ventures that improve the lives of millions of customers, consumers, citizens and patients.

Contributors

We could not have created this report without the support, knowledge and insights of AI experts and KPMG professionals around the world who contributed their time to this report.

Thank you to:

External contributors

Erik Brynjolfsson
Professor and Senior Fellow at the Stanford Institute for Human-Centered AI (HAI), Director of the Stanford Digital Economy Lab

Editorial board

Leanne Allen
Partner, FS Consulting Technology and Data, Data Science & AI Capability Lead
KPMG in the UK

Lisa Bigelow
Managing Editor, Advisory Insights
KPMG in the US

Gerrit Bojen
Partner, Head of Technology & Finance Consulting, Financial Services
KPMG Deutschland

Rebecca Brokmeier
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Global Chief Marketing Officer
KPMG International

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KPMG in the US

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Senior Associate Director
Customer Excellence Centre
KPMG in the UK

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KPMG International

Benedikt Höck
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KPMG in Germany

Scott Marshall
AI-enabled Digital Transformation
KPMG International

Joseph Parente
Principal, AI Consulting Leader
KPMG in the US

Jeff Potter
Head of Advisory Insights
KPMG in the US

David Rowlands
Global Head of Artificial Intelligence
KPMG International

René Vader
Global Markets AI Lead
KPMG International

Sector editorial group

Jonathon Gill
Global Head of Industrial Manufacturing
KPMG International

Martin Kaestner
Technology Leader, Industrial Manufacturing
KPMG in the US

Carmelo Mariano
EMA Head of Industrial Manufacturing
KPMG in Italy

S Sathish
Partner and National Sector Leader Industrial Manufacturing
KPMG in India

Adrian Clamp
Global Head of Connected Enterprise
KPMG International

Contacts

Jorge Sáinz
Socio responsable de Industria y Automoción de KPMG en España
jsainz@kpmg.es

María Victoria Pascual-Heranz
Senior manager de Industria y Automoción de KPMG en España
mvpascual@kpmg.es

kpmg.com/intelligentmanufacturing

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