Industrial Robotics: The Future of Automation

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The use of industrial robotics in manufacturing is not a new concept – it has been around for decades. The new and exciting part of robotics lies in the technological advancements and increasing integration that is transforming what robots can do and where they can be used. The future of robotics is not in static environments – it's in machines that move, adapt, and respond to real-world conditions.

Collaboration between humans and robots can lead to smarter, more efficient, and more sustainable operations, making robotics a key pillar of the future of automation. This paper will provide an overview of the current robot market, the technological developments of the future, and the perspective of technology producers and users.

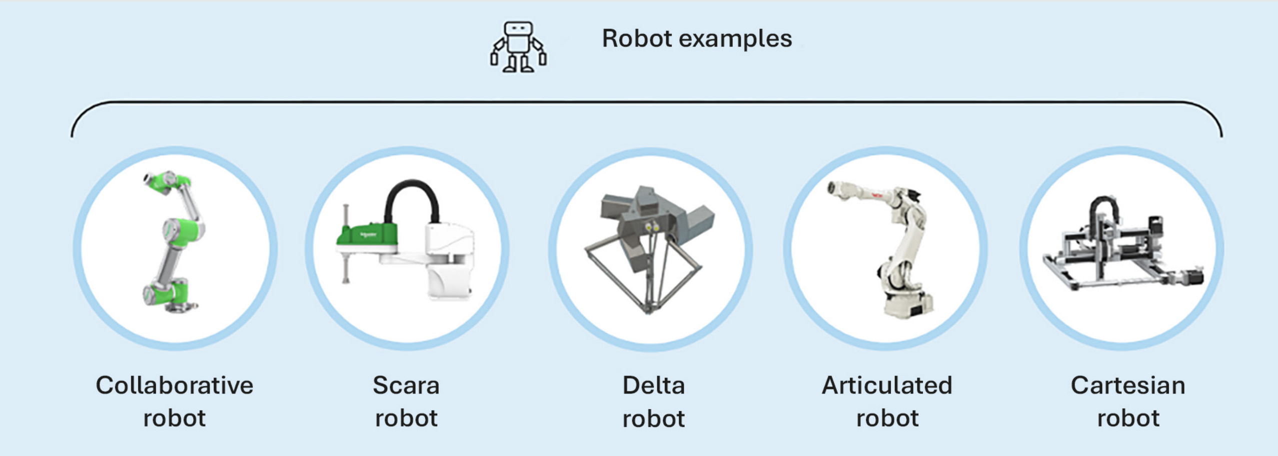
What are industrial robots?

Types of industrial robots

An industrial robot is an automatically controlled, reprogrammable, multipurpose manipulator that is programmable in three or more axes, which can be either fixed in place or mobile for use in industrial automation applications. There are several types of industrial robots (see **Figure 1**).

- Collaborative robots (cobots) are an automated robot that are designed to work safely alongside human workers in a shared collaborative workspace. Cobots are often used in light assembly, machine tending, and quality inspection due to the ease of use and flexibility of the product.
- SCARA robots have two parallel rotary joints to provide compliance in a horizontal/vertical plane. This allows for fast and precise horizontal movements, making them ideal for pick-and-place, assembly, and packaging operations.
- Delta robots consist of three lightweight arms connected to universal joints at the base, enabling extremely fast and accurate movements, especially in high-speed picking and sorting applications like food or electronics.
- Articulated robots feature multiple rotary joints, resembling a human arm, and is commonly used for tasks like welding, painting, and assembly due to its high flexibility and wide range of motion.
- Cartesian robots, also known as gantry robots, move along three linear axes (X, Y, and Z), offering high precision and rigidity, which makes it suitable for CNC machining, 3D printing, and heavy-duty material handling.

Figure 1: Robot examples



Source: IDC

Complementary Automation Technology

Multi-carrier transport systems use independent, magnetically driven shuttles to move products precisely and flexibly along a track. While not robots themselves, they are best classified as advanced industrial automation equipment. These systems play a critical role in robotic and automated workflows by acting as the intelligent backbone of motion—enabling scalable, reconfigurable, and software-defined automation that complements and enhances robotic systems.

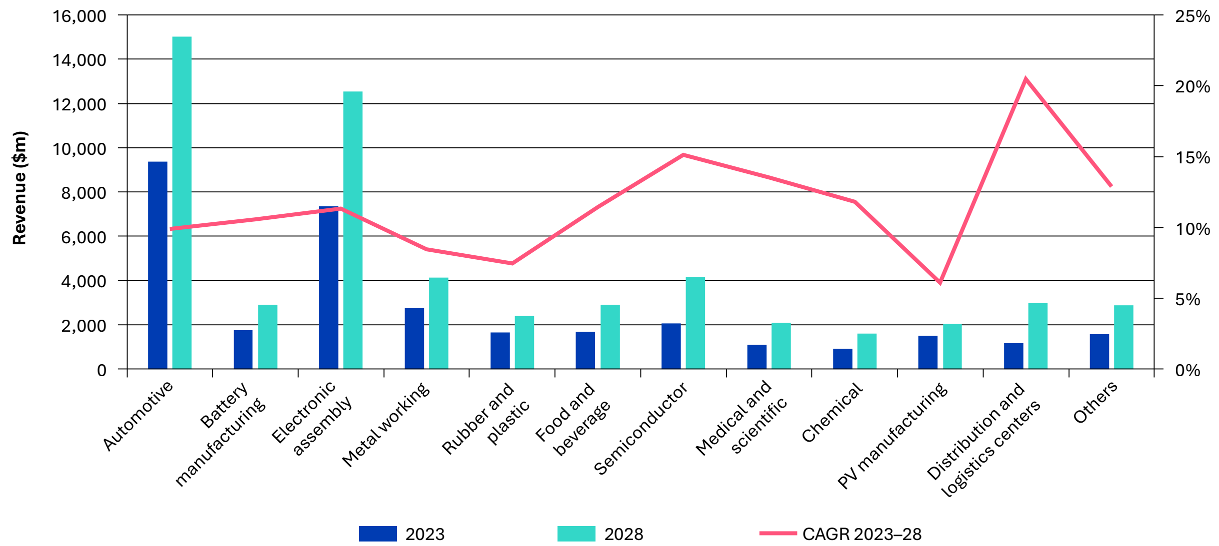
Where are industrial robots used?

According to Omdia's *Industrial Robotics and Automation* report, the industrial robot market was estimated to be valued at almost $36bn in revenue in 2024, with over 1-million-unit shipments.

The automotive and electric assembly industries were the largest markets for robots, based on revenue and unit shipments, accounting for almost 50% of all industrial robot sales and units.

In 2025 and beyond, the automotive, electronic assembly, semiconductor, medical equipment, food processing, aerospace, and logistics and warehousing industries will continue to drive the growth in demand for industrial robots (see **Figure 2**). The pursuit of high precision, high efficiency, and high-quality production, along with the need for automation and intelligent technologies, will bring new opportunities to the industrial robot market.

Figure 2: The world market for robots (excluding humanoid robots) by industry



Source: Omdia

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Who is building industrial robots?

China, Japan, and South Korea are home to many of the robot manufacturers, which contribute to the strong output from the Asia & Oceania region. Asia & Oceania was the largest market for industrial robots, accounting for roughly 60% of global revenue.

A significant portion of this was attributed to China. As a global manufacturing center, China's industrial robot production capacity accounts for over half of the global industrial robot production capacity.

According to interviews from Omdia's *Industrial Robotics and Automation* report, over 20% of China's industrial robot production was exported in 2023 and 2024. This number is expected to increase in the future as global manufacturing investment and activities transfer to lower-cost regions, such as India and South-Eastern Asia.

In 2024, the industrial robots market size in Europe, the Middle East & Africa (EMEA) and the Americas were estimated to be similar, with both influenced by geopolitical factors.

Owing to the impact of the Russia-Ukraine war in 2022 and inflation, the cost of raw materials in Europe has risen, which caused the price of industrial robots in Europe to rise by approximately 3–5% in 2023, and again slightly in 2024. This has created challenges for robot producers in Europe when competing with internationally recognized brands from lower-cost manufacturing nations.

In the US, after the result of the US elections, traditional manufacturing industries, such as automotive, metalworking, machine tools, and semiconductor industries are expected to grow due to a more concentrated policy focus, which should create new opportunities for the industrial robot industry.

Figure 3: The deployment status of robots in the manufacturing process

Source: Omdia

According to Omdia research, the industrial robots market is expected to double in size over the next five years. This view aligns with Omdia's global Industrial Robotics and Automation End-User Survey – 2024, which reported that over 80% of respondents plan to deploy or expand robot deployments in the next three years (see **Figure 3**).

Robotics innovations

The future of robotics lies in machines that adapt, respond, and integrate into real-world environments. Modern robotics is no longer focused on isolated machines performing single tasks – it's about system-wide integration, leading to transformative change.

Robots can connect seamlessly with ERP, MES, WMS, and IoT platforms, enabling real-time data exchange, adaptive operations, and predictive maintenance. Whilst unified control systems and plug-and-play ecosystems reduce complexity and speed up deployment.

As stand-alone products, robots can automate tasks; but integrated robots can transform the entire operating system. System integration is the next step in robotics.

Machine learning and AI

AI and machine learning are transforming manufacturing robots from programmed machines into intelligent systems that can learn and adapt. AI-powered robots can analyze their environment through cameras and sensors, making real-time decisions about how to handle parts that are not perfectly positioned or identifying quality issues as they occur.

This means robots can work with greater flexibility, handling product variations and unexpected situations without requiring reprogramming by operators.

Machine learning enables manufacturing robots to continuously improve their performance through experience. By collecting and analyzing data from thousands of repetitions, robots can identify patterns that lead to better outcomes and adjust their operations accordingly.

For example, a welding robot might analyze factors such as material temperature, application pressure, and environmental conditions to optimize weld quality over time.

This self-improvement capability means robots become more valuable the longer they operate, unlike traditional equipment that typically degrades.

Edge and cloud robotics

Cloud robotics has the potential to transform manufacturing operations by enabling improved levels of connectivity, intelligence, and scalability. By leveraging cloud infrastructure, robots can now access almost unlimited computational resources, allowing them to perform complex calculations, run sophisticated AI algorithms, and process massive datasets that would be impossible with onboard computing alone.

Cloud robotics enables remote monitoring and management of global robot fleets, allowing manufacturers to standardize operations across multiple facilities while maintaining centralized control and visibility.

Edge robotics complements cloud capabilities by bringing critical processing power directly to the factory floor, addressing latency challenges that could otherwise compromise performance in time-sensitive applications. By processing data locally at the "edge" of the network, robots can make split-second decisions essential for tasks such as collision avoidance, real-time quality inspection, and precise synchronization with other machines.

Edge computing also addresses data privacy and security concerns by keeping sensitive operational data local rather than transmitting everything to external cloud servers. The combination of edge and cloud creates a hybrid architecture that optimizes both responsiveness and scalability. Routine operations happen at the edge for maximum speed, while complex analytics and machine learning occur in the cloud where computational resources are abundant.

> “The integration of AI and data collection with robotic systems creates a powerful value proposition: the ability to reduce uncertainty in manufacturing processes.”

Flexible automation

Unlike traditional fixed automation systems that require extensive retooling for product changes, modern robotic systems can be rapidly reprogrammed to manage different tasks, components, and production sequences. New robots are more modular, mobile, and adaptable, making them suitable for custom manufacturing.

This allows manufacturers to efficiently produce multiple product variants on the same line and quickly adapt to changing market demands without significant capital investment.

Modern robots can also identify and adapt to variations in part positioning, detect quality issues in real time, and make autonomous adjustments to their operations. These cognitive capabilities enable robots to work effectively with less structured inputs and greater process variability.

Mobile robotic platforms further enhance manufacturing flexibility by eliminating fixed infrastructure requirements, allowing production layouts to be reconfigured quickly as needs change.

This mobility, combined with collaborative robot designs that can safely work alongside humans without protective barriers, creates dynamic work environments where human creativity and problem-solving works closely with robotic precision and consistency.

Collaborative robots

Unlike traditional industrial robots, which require physical fencing, collaborative robots (cobots) can work side by side with human operators without physical isolation. Cobots are used for a variety of tasks, including packaging, palletizing, machine maintenance, and quality inspection in multiple industries, such as automotive manufacturing, food and beverages, electronics, hospitality, and healthcare.

Cobots provide safety, flexibility, and ease of use, and have a lower average selling price compared to other types of robots, which perfectly meet the requirements of most manufacturing industries.

Next-generation collaborative robots and systems are aiming to create a true partnership between humans and robots in the industrial environment, with the implementation of AI and machine learning. Future advancements include:

- Adaptive safety zones that adjust robot behavior based on human proximity
- Intent recognition anticipating human actions to optimize collaborative workflows
- Augmented reality interfaces providing intuitive control and monitoring capabilities
- Intuitive teaching interfaces allowing workers to demonstrate tasks to robots rather than using code to program them.

All of this creates advantages and opportunities for both OEMs and end users as collaborative technologies open new market segments previously resistant to automation. These advancements will enable automation of complex processes, rapid redeployment of resources for different products without the need for specialized programming, and preservation of human expertise while eliminating workplace safety risks.

Sensing and vision systems

Manufacturing could be revolutionized through new sensing and vision systems that enable robots to perceive, interpret, and interact with their environment with more precision and adaptability.

Many robots now employ advanced 3D vision systems, including structured light scanning, time-of-flight cameras, and stereo vision techniques that enable precise part identification, accurate depth perception, and improved spatial awareness in complex production environments. These capabilities have improved robots' ability to perform intricate tasks such as bin picking, assembly, and quality inspection with high precision.

Machine vision systems offering 3D capabilities are being used in applications for logistics and transportation. 3D technology addresses the challenge of bulk stacking, which is a bottleneck in the current application of 2D vision systems.

Some machine vision suppliers are also introducing short-wavelength infrared (SWIR) cameras for use in robotics. These cameras enhance visibility, especially in filling inspection and foreign material inspection during the food production process and in the lamination process of silicon wafers in semiconductor manufacturing.

The integration of multi-modal sensing has further revolutionized manufacturing automation by combining visual data with force, tactile, and proximity sensing. This multi-sensory approach has made robots more adaptable to changing production requirements and capable of working safely alongside human operators in collaborative settings.

Users of robotics

The industrial and manufacturing landscape is entering a period of transformation as robotics and AI become more integrated, creating enhanced capabilities for factories worldwide. This represents a fundamental shift in how production systems operate, learn, and deliver value. For both OEMs and manufacturers, understanding this transformation and collaborating is essential for strategic positioning in an increasingly competitive global marketplace.

OEM perspectives

A key challenge identified by OEMs is ensuring compatibility between innovative robotic systems and existing manufacturing equipment. Forward-thinking OEMs are addressing this challenge by developing flexible integration architectures that allow their robotic solutions to connect with diverse production environments. Those that excel at solving this compatibility challenge can gain significant competitive advantage.

Robotics as a service

This dynamic is creating a paradigm shift in the OEM landscape, enabling OEMs to move from being equipment providers to solution partners. Robotics as a service (RaaS) is offering businesses access to industrial robots through a subscription model, reducing initial capital outlay and maintenance costs. RaaS simplifies the automation process with comprehensive support and maintenance, while also providing a consistent and recurring revenue stream to OEMs.

Some features of RaaS include:

- Developing predictive maintenance capabilities that maximize equipment uptime
- Creating adaptive systems that optimize performance based on operational data
- Building platforms that support continuous improvement through machine learning
- Offering outcome-based service models tied to production results rather than equipment specifications.

RaaS is one way OEMs can differentiate themselves in a competitive market, adding value beyond the mechanical product. This creates a strong reputation, leading to a sound brand positioning and the potential for premium pricing strategies.

Robot fleet management

The integration of robot fleet management and cloud platforms is another way OEMs can add value beyond the mechanical product. Robot fleet management refers to the systems and software used to monitor, control, and coordinate a group of robots operating together. This technology is particularly important in warehouses, distribution centers, and other environments where multiple robots work simultaneously.

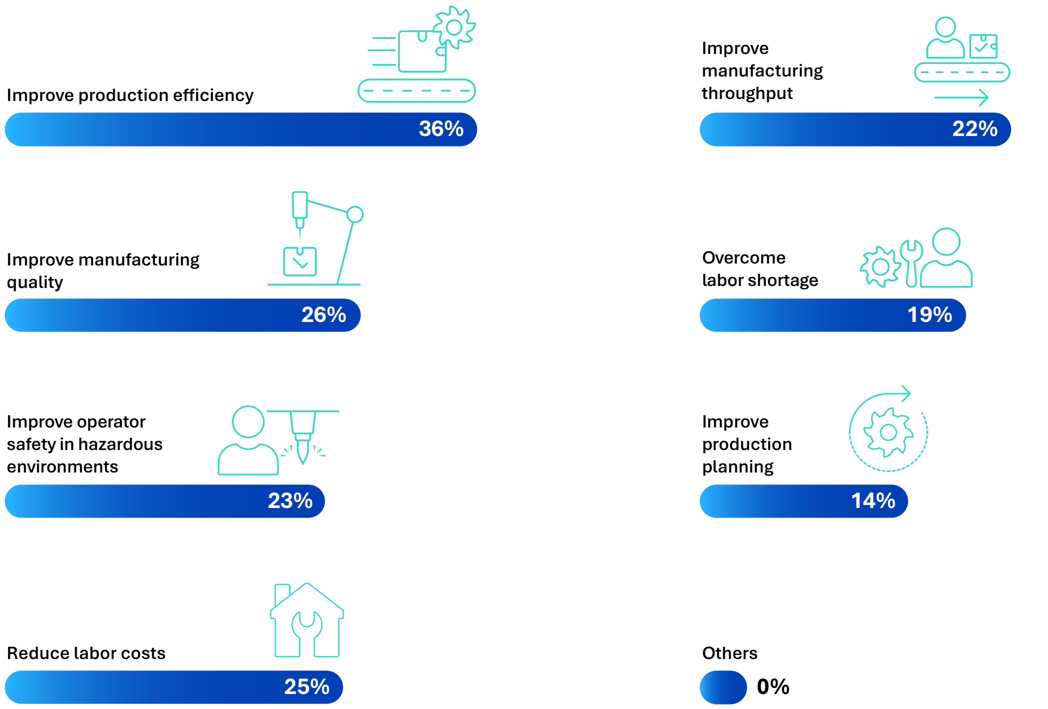
Robot fleet management optimizes task allocation and reduces idle time in multi-robot systems, ensuring that robots are deployed efficiently to increase output. By incorporating edge computing, OEMs can enable data-driven decision making and real-time control that reduces latency to improve performance.

These developments create the potential for new revenue streams, increased machine value, and product differentiation for OEMs. Subscription-based services, such as monitoring, analytics, and optimization, create the potential for added value business partnerships and more premium brands; aftermarket sales could be boosted by offering software modules, AI models, or upgrades for existing equipment; and the potential to partner with integrators or new platform creators could open new markets that were previously hard to reach.

Manufacturing end-user perspectives

Based on Omdia's *Industrial Robotics and Automation End-User Survey – 2024*, the main benefits of using robots in manufacturing were to improve production efficiency, improve manufacturing quality, and reduce labor costs (see **Figure 4**).

Figure 4: Top benefits that the world market aims to achieve via new robot deployments



Source: Omdia

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Increased throughput

For manufacturing end users, AI-enhanced robotics enables highly personalized manufacturing capabilities, adjusting production in real time to meet specific consumer demands. This flexibility allows for faster and more accurate production from design to delivery, while improving efficiency and positively impacting profitability.

AI-powered robots can work faster and adapt to changing tasks without downtime. This enables better robot fleet management to improve task distribution and minimize idle time, while collaborative robots allow humans and machines to work side by side, increasing overall output.

Production flexibility

Manufacturing end users benefit from the development of adaptive automation systems that can respond intelligently to changing production requirements. These systems combine the precision and consistency of traditional automation with the flexibility and learning capabilities of AI, creating manufacturing environments that can efficiently produce both high-volume standardized products and customized, small batch runs.

Modular and mobile robots can be reconfigured quickly for new products or workflows, while cloud and edge integration enable real-time adjustments and remote control. This supports mass customization and short production runs without the need for major retooling.

Multicarrier systems can enhance flexibility by enabling dynamic routing and reconfiguration of mobile robots and transport units. These systems allow multiple carriers to operate independently on a shared track, adapting in real time to production changes, bottlenecks, or priority shifts. When integrated with mobile robots, multicarrier technology facilitates seamless transitions between tasks, zones, or product types – minimizing downtime and maximizing throughput in highly variable manufacturing environments.

Improved operational performance

Robots have revolutionized manufacturing operations by enhancing efficiency across multiple business areas. By incorporating the latest technology into robotics, there is potential for further improvements for manufacturers.

The use of AI and data-driven decision making can reduce the overall cost of operations by enabling predictive maintenance to be more effective, reducing unplanned downtime and repair costs, while energy-efficient systems lower utility bills.

In terms of inventory and process optimization, robots integrated with MES, ERP, and WMS systems provide real-time data on performance, inventory, and quality, while AI analytics help identify bottlenecks, inefficiencies, and opportunities for improvement. All of this enables continuous improvement and can be used to support lean manufacturing practices.

Enhanced safety

Robots have transformed workplace safety across numerous industries by taking on hazardous tasks that would otherwise put human workers at risk. Technological developments in cobots and smart sensors have enabled these technologies to reach new applications to further reduce workplace injuries related to repetitive strain, falls, burns, and exposure to harmful substances.

Modern robots are also equipped with sophisticated vision and perception systems to help robots navigate safely around humans and obstacles. These sensors and safety mechanisms automatically stop operations when humans enter designated safety zones, creating an additional layer of protection in mixed work environments.

The implementation of cobots has further enhanced workplace safety by introducing machines specifically designed to work alongside humans without the need for safety barriers. These robots incorporate advanced force-limiting technology that detects unexpected contact and immediately stops movement, preventing injuries during human-robot interactions.

Sustainability

Robots significantly enhance energy efficiency in manufacturing operations. Modern robots are equipped with advanced sensors and software that dynamically adapt to changing conditions, modulating their energy consumption based on the task at hand.

The energy benefits extend beyond direct operation. By reducing rework and scrap, robots eliminate the energy that would have been wasted on failed products or correction processes. Whilst many modern robotic systems also incorporate energy-efficient motors, regenerative braking, and optimized motion planning to further minimize their environmental footprint and help companies to meet regulatory and ESG goals.

Robots are becoming instrumental in supporting circular economy practices within manufacturing. They excel in remanufacturing and refurbishing processes, where old products are restored to usable condition. Through lifecycle tracking and precise operations, robots can dismantle products and segregate components that can be reused, making product recovery economically viable at scale.

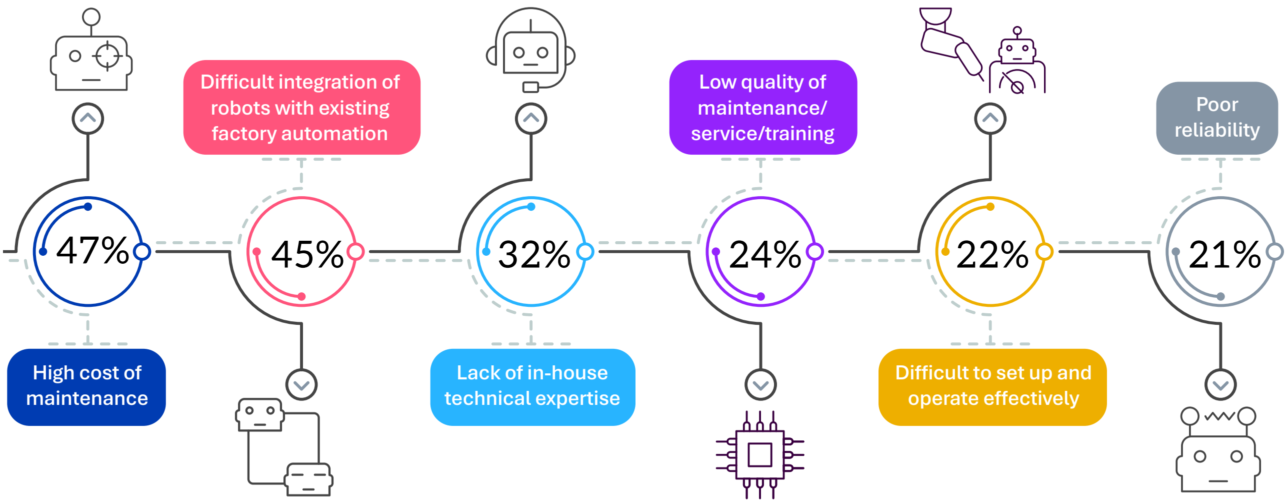
Despite the clear benefits of industrial robotics in manufacturing environments, many organizations continue to face significant barriers to adoption. By addressing these challenges strategically, manufacturers can increase their automation levels and realize the competitive advantages that robotic systems offer.

Challenges and barriers in robot adoption

The respondents in Omdia's *Industrial Robotics and Automation End-User Survey – 2024* said that the top three challenges in utilizing robots were the high cost of maintenance, difficult integration of robots with existing factory automation, and lack of in-house technical expertise (see Figure 5). These challenges were also major considerations for organizations in the process of selecting robots.

The manufacturing industry is often slow to change and adapt to new technologies and automation. Many manufacturers report that their general lack of experience and knowledge with robotics creates challenges in implementing new automation products. This leads to a lack of clear business case for robot technology, creating low business confidence or unrealistic expectations around the investment.

Figure 5: Top challenges encountered by the world market when utilizing robots



Source: Omdia

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The results from this survey suggest that automation companies should be able to obtain better market opportunities if they can align their automation offering with their robotic offering. In this way, automation providers can share their expertise to create a solid business case for investment, integrate their robots and automation products to ensure smooth integration of products, and offer maintenance contracts to assist end users in overcoming technical challenges.

The most successful organizations will be those that view robotics implementation as a strategic direction rather than a one-time project. By starting with well-defined applications offering clear returns, building internal capabilities through experience, and taking an incremental approach to expansion, companies can transform the challenges of robotics adoption into opportunities for competitive advantage.

> Cost savings compared to traditional methods/ Reduction in CO_2 emissions or e-waste volumes.”

OEM case study I

Integrated robotics revolutionizes the reuse of semi-conductors – reducing e-waste

In a collaborative process with automation vendors and leading institutions, the OEM developed an integrated robotics solution that automates the recovery and reuse of microchips from used circuit boards, significantly reducing e-waste and supporting the circular economy.

The solution

A combination of cobot, SCARA, digital twin, and multicarrier technologies, integrated with AI and automation, to create a flexible, all-in-one machine capable of desoldering and reprocessing various chip types from diverse circuit boards.

Customer benefits

- Reduced e-waste – enables efficient recovery and reuse of microchips, minimizing landfill contributions.
- Cost savings – lowers production costs by reusing valuable components instead of sourcing new ones.
- Supply chain resilience – reduces dependency on volatile semiconductor supply chains.
- Sustainability compliance – supports ESG goals and regulatory compliance through circular economy practices.
- Operational efficiency – automates complex manual processes, increasing throughput and consistency.
- Flexibility – handles a wide variety of chip types and board formats with minimal reconfiguration.
- Innovation enablement – frees up resources and budget for R&D by reducing material costs.
- Brand value – enhances corporate image through visible commitment to sustainability and innovation.

References

https://blog.se.com/digital-transformation/2024/07/08/how-integrated-robotics-are-revolutionizing-the-reuse-of-semi-conductors-reducing-e-waste-and-contributing-to-the-circular-economy/

"Investment divided by 3, production capacity increased from 2 million to 6.5 million units a year."

OEM case study II

Flexible automatic line: Smart robotics, seamless flexibility, and scalable production

Schneider Electric's electrical components factory needed to evolve from producing a single push-button references to assembling seven different references – each comprising up to 31 individual parts – on a single, highly flexible automated line.

The solution

Schneider Electric's flexible automatic line, integrating:

- Lexium MC12 Multi Carrier
- Lexium Robotics (SCARA, Cobot, T/P)
- EcoStruxure Machine Expert Twin and SCADA
- PacDrive 3 Motion Control
- Modular design with digital twin and robotics integration.

Customer benefits

- Investment divided by 3 – one flexible machine replaces three traditional lines.
- Footprint divided by 3 – significant space and cost savings.
- Changeover time < 1 minute – new series can be prepared during the previous one.
- Production capacity increased from 2 million to 6.5 million units a year.
- +30% energy efficiency – compressed air replaced by electric actuators.
- High flexibility – from 1 to 7 references, 10 to 31 parts.
- Modular design – easy to expand and adapt to future product needs.
- Digital twin – enables parallel engineering and reduces commissioning time by up to 60%.
- Simplified maintenance – remote access and seamless integration of robotics and automation.

Conclusions

The integration of robotics and AI could revolutionize the manufacturing industry, driving unprecedented levels of efficiency, productivity, and sustainability. As we move toward a future where smart factories become the norm for greenfield developments, the collaboration between OEMs and manufacturers will be crucial in overcoming the challenges and fully leveraging the benefits of these advanced technologies.

The most successful implementations will emerge from partnerships where OEMs, technology suppliers, integrators, and manufacturers work together to develop solutions that address real-world manufacturing challenges. Through these collaborative relationships, all parties can accelerate innovation, improve efficiency, and maximize the value created by these transformative technologies.

By embracing innovations such as AI, industrial IoT, collaborative robots, robot fleet management, and system integration – and by addressing key challenges through standardization, workforce upskilling, and strategic partnerships – the manufacturing sector can unlock a new era of growth and competitiveness. This transformation will not only enhance operational efficiency but also foster a more sustainable, resilient, and future-ready industrial landscape.

Appendix

Methodology

Data and insight was gathered through Omdia syndicated research on the robotics industry. Sources of data include primary research, secondary research, questionnaires, interviews, industry trackers, and market surveys.

Further reading

Industrial Robotics and Automation End-User Survey – 2024 (April 2024)
Industrial Robotics and Automation – 2024 Analysis (January 2025)
Industrial Robotics and Automation – 2024 Data (March 2025)
Industrial Robotics and Automation Market Tracker – 1Q25 Analysis (April 2025)

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