



Robotics and Automation

12%

Average annual growth in the supply of industrial robots from 2009 to 2026E¹

\$374 billion

Estimated value of global market for autonomous vehicles in 2030²

3 out of 10 companies

European manufacturing companies reported production constraints in 2022 due to a shortage of workers³

¹ Source: IFR World Robotics 2023 Report.

² Source: <https://www.businessresearchinsights.com/es/market-reports/toc/autonomous-vehicles-market-106395>

³ Source: <https://www.weforum.org/reports/the-future-of-jobs-report-2023/in-full/1-introduction-the-global-labour-market-landscape-in-2023#1-introduction-the-global-labour-market-landscape-in-2023>



The robotics industry has entered a more dynamic phase of development and we believe it will become dominant over the next decade

What do we mean by robotics?

Robotics is an interdisciplinary scientific field that combines various branches of engineering to **create robotic machines designed to perform automated tasks and functions that, in some cases, simulate human capabilities and skills**. The main difference between robotics and **automation** lies in both approach and functionality. Robotics focuses on designing, building and programming specific robots to perform particular tasks, while automation refers to the process of automating tasks using technology, which may include, but is not limited to, robots.

The **robotics industry has entered a more dynamic phase of development**. The EU's Robotics 2020 Strategy sums up the outlook as follows: Robotic technology will become **dominant over the next decade**. It will shape all aspects of work and home. Not only is Robotics transforming existing industries, from manufacturing and healthcare to agriculture and services, but it is also paving the way for new sectors to emerge.

With its **ability to boost productivity, cut costs and help solve the problems linked to global labour shortages**, we believe growth in robotics and automation may outpace that of the economy as a whole. This offers a thematic investment opportunity, both in the companies that manufacture robots and in those that provide all the necessary components, from semiconductors to software.

Main types of robots



Industrial robots

According to the International Federation of Robotics, the term "industrial robot" refers to "an automatically controlled, reprogrammable, multipurpose manipulator programmable in three or more axes, which can be either fixed in place or mobile for use in industrial automation applications" (as defined by ISO 8373: 2012).

These robots can be differentiated by the technology they employ (AI, machine vision...), by their shape (**humanoid robot** or **robotic arm**) and by the work they can do, whether as a fixed heavy industrial robot, or as a **collaborative robot (co-bot)**. Robotic arms can have up to six axes and there are multiple options, such as **Cartesian robots**.



Service robots

These robots replace or support humans in **undertaking routine service tasks**. As described by the International Federation of Robotics (IFR), service robots "perform useful tasks for humans (...) excluding industrial automation applications."¹ Their usefulness and applications in the labour market are unlimited.

There are three kinds of service robot² **Class 1**: replacing humans in heavy, hazardous and monotonous tasks; **Class 2**: operating in close conjunction with humans to improve their well-being by entertaining, assisting the elderly, transporting patients, etc.; **Class 3**: able to operate on humans, as in medical robots used in diagnosis, surgery, therapy and rehabilitation.



Nanorobots

These are nanometric-sized robots that are now used mainly in medicine and scientific research. According to Peter Diamandis, co-founder and executive chairman of Singularity University, "Nanotechnology has the potential to solve some of the biggest problems that the world faces today," such as targeting cancer cells or developing ultra-fast microprocessors that consume less energy³.

¹ Source: IFR World Robotics 2023.

² Source: The future of work: Robotics, 14/09/22.

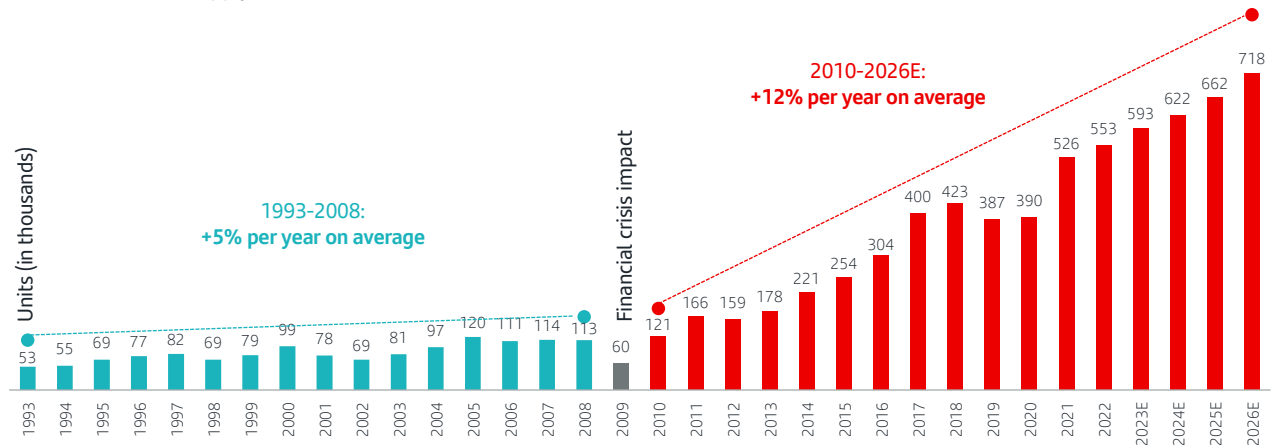
³ Source: <https://www.eex-celence.es/entrevistas/con-talento/nanorobots-situacion-actual-y-el-porque-de-su-impresionante-futuro>

Prospects for the robotics industry

Robotics has experienced exponential growth in recent decades and this trend is expected to continue over the next few years.

The chart below, taken from the IFR World Robotics Report 2023, shows how the global supply of industrial robots has grown since 1993. Since 2010, average annual growth has more than doubled, from 5% to 12%.

Worldwide annual supply of industrial robots



Main drivers

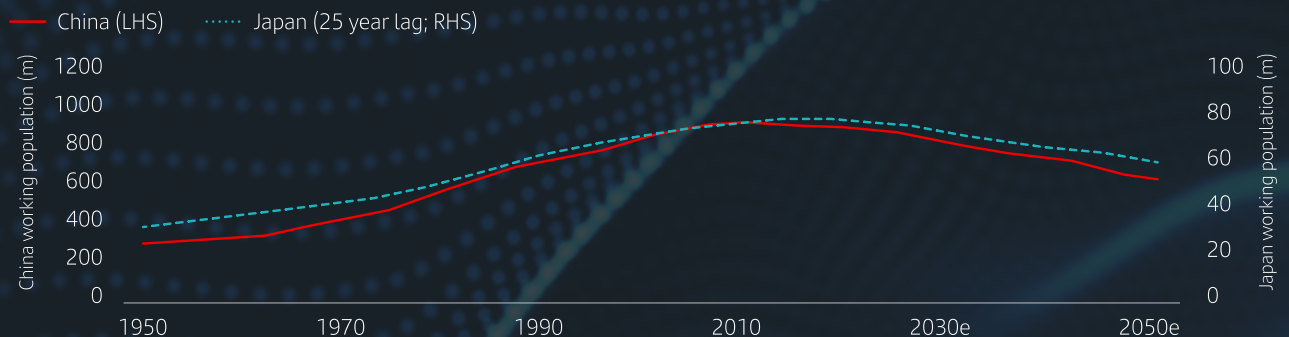
Labour shortages

The global working-age population is declining and labour shortages are disrupting supply chains across all sectors.

5 out of 10 vacancies for skilled workers in the U.S. manufacturing industry remain unfilled¹, while China expects 30 million unfilled manufacturing job vacancies by 2025².

In Europe, almost 3 out of 10 manufacturing companies reported production constraints in 2022 due to a shortage of workers³. Competition to attract talent could become fiercer in the next decade as the baby boom generation retires and the global birth rate continues to decline.

Working population are contracting... (eg. Baby boomer restrig, falling fertilit rates) – China & Japan Working population



Source: Berenberg Research, United Nations World Population Prospects (2015).

1 Source: <https://www.themanufacturinginstitute.org/press-releases/manufacturing-industry-faces-unprecedented-employment-shortfall-2-4-million-skilled-jobs-projected-to-go-unfilled-according-to-deloitte-and-the-manufacturing-institute/>

2 Source: <https://www.scmp.com/economy/china-economy/article/3215980/chinas-factories-try-manufacture-their-way-out-shortage-both-jobs-and-hi-tech>

3 Source: <https://www.weforum.org/reports/the-future-of-jobs-report-2023/in-full/1-introduction-the-global-labor-market-landscape-in-2023#1-introduction-the-global-labor-market-landscape-in-2023>

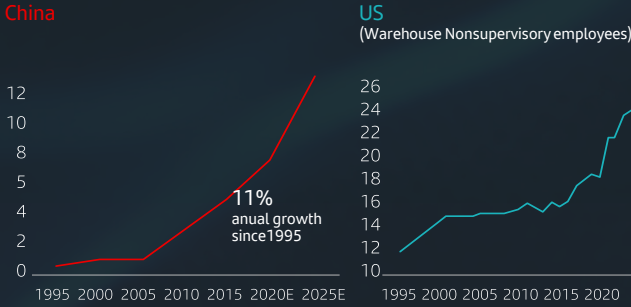
Main drivers (2)

High labour costs

On average, labour costs have risen globally. Following moderate increases in the second half of 2023, labour costs in the US registered their largest year-on-year increase in the first quarter of 2024 despite the Biden Administration’s subsidies and stimulus policies.

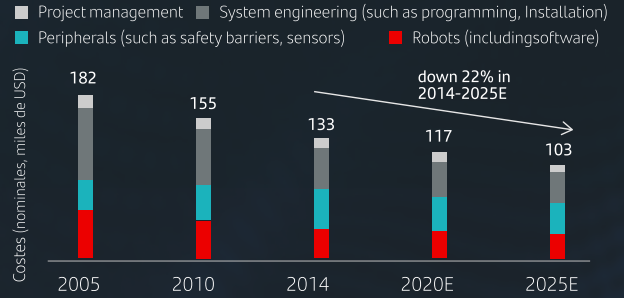
This is coupled with the decline in the cost of implementing robots in recent years, which is driving sales of industrial robots.

Labour costs are rising...



Source: BofA Merrill Lynch Thematic Investing, Robot R- evolution – Global Robot & AI Primer (November 2015), Oxford Economics and the US Bureau of Labor Statistics, The current Employment Statistics (CES), February, 2024.

... while Robots are cheaper & more flexible



Source: ABB, Economic Justification for Industrial Robotic Systems, 2007; International Federation of Robotics, World Robots.

Artificial Intelligence (AI) and Computing

A robot’s programming complexity varies depending on its usefulness and we are at a time when Artificial Intelligence and Big Data are revolutionising robotics.

As machines become more sophisticated, they need more processing power to compute and process data. In addition, AI consumes copious resources, calling for more sophisticated semiconductors. Computer processor manufacturers appear to be the logical beneficiaries of AI expansion. The level of innovation and incorporation of AI into software enables chip designers to accelerate the design phase and improve computational energy efficiency. In addition, strides in AI should boost prospects for semiconductor equipment manufacturers. They provide chip manufacturing tools that produce smaller, faster, cheaper, and more powerful, energy-efficient microchips.

Continuous improvements in AI and machine learning are making automation systems smarter and more adaptable. This means that the robots of the future will not be confined to performing repetitive tasks, but will also make complex decisions, analyse data in real time and learn from their environment, thus improving productivity and reducing human error.

Example of A.I. application



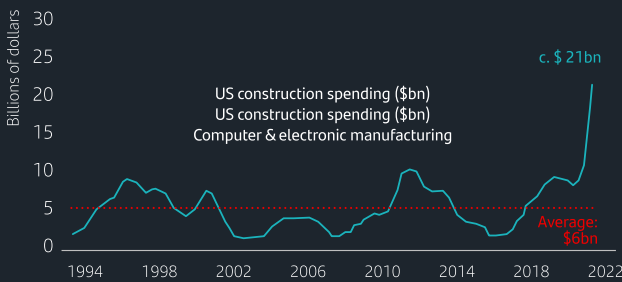
Source: AXA IM. AXA World Funds Robotech presentation, October 2024.

Main drivers (3)

Reshoring and nearshoring

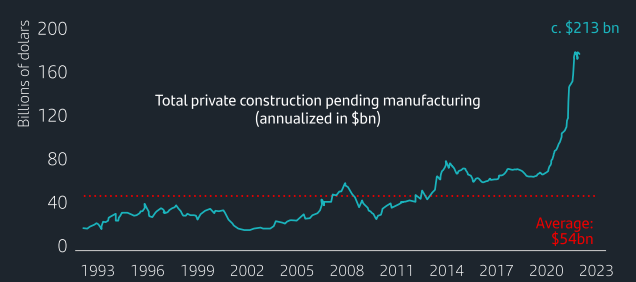
Supply bottlenecks during the COVID-19 pandemic highlighted the dangers of relying on distant countries for manufacturing. Geopolitical tensions between the US and China, along with the Ukraine war, compounded the pressure on global supply chains. As a result, governments and companies are increasingly looking to move production to their home territories, a process known as “reshoring” and “nearshoring”. This should spark an increase the demand for industrial robots to work in these new factories, as well as for other automation equipment and software solutions.

Large increase in semiconductors capital expenditure (CAPEX)



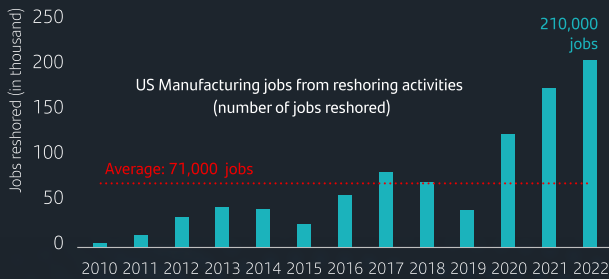
Source: US Census Bureau, Construction spending data, 01/12/2022.

Companies are investing heavily at the moment



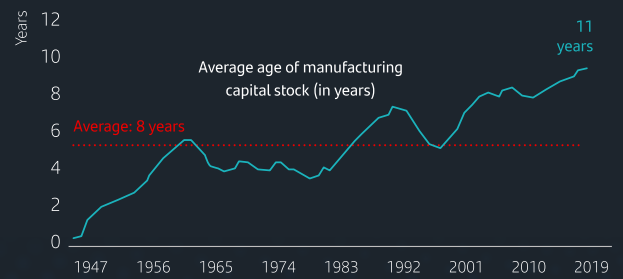
Source: Federal Reserve Bank of St. Louis, Economic Research Division, Total Private Construction Spending: Manufacturing in the United States, millions of dollars, monthly, not seasonally adjusted, 01/12/2023.

Jobs are coming to the US



Source: Reshorennow.org, Reshoring Initiative, 2022 Q3 Data Report.

US machinery is at the oldest it's ever been



Source: US Bureau of Economic Analysis (BEA), Current-Cost average age at yearend of private equipment by industry, 30/09/2022.

The semiconductor sector features heavily in the push for reshoring, owing to the increasingly essential role of semiconductors and other related technologies, as well as national security concerns. The enactment of three laws in the United States, with a budget of close to 2 trillion dollars, heralds a sea-change in American interventionism to promote reshoring. Similar incentives have been adopted in other countries and economic blocs.

Signed into Law

\$1,2tn

Infrastructure investment and jobs act
(signed Nov. 21)

Over 10,000 programmes (ranging in size c. \$100,000 to \$3bn)

\$250bn

The chips and science act
(signed Aug. 22)

Including:

- \$39bn direct spending for US semiconductor manufactures
- \$24bn tax credits for domestic manufacturing facilities of semiconductors
- \$13bn for semiconductor research and workforce training

\$370bn

Inflation reduction act
(signed Aug. 22)

Investment focused on energy, climate and healthcare initiatives

Clean energy production and manufacturing

Source: Ashtead Group, half year result, 06/12/2023.

The main applications of robotics

Industrial Automation

Although robots were originally only present in heavy industry, new technologies present significant growth potential in other markets, from pharmaceutical firms automating drug warehouses, to automated salmon trimming.

The development of **advanced sensors** and **microprocessors** in the last decade has also paved the way for **co-bots**. Co-bots can work alongside people rather than having to be segregated for safety reasons.

The global co-bot market is projected to reach 6.8 billion dollars in 2029, up from 1.2 billion dollars in 2022, equivalent to a **compound annual growth rate of 34%**¹.



Source: AXA IM. Co-bot trabajando con humanos.

Main pros

Increased accuracy and quality of manufacturing and assembly

Improved efficiency

Greater production volume

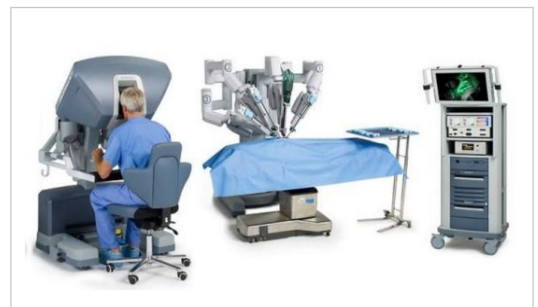
Improved occupational safety

Applications in healthcare

Robotic surgery is generally associated with **minimally invasive procedures**, i.e. those performed through small incisions, currently focused on hernia and colorectal operations. In addition, it is sometimes used in certain conventional open surgeries.

The most commonly used clinical robotic surgical system features a **camera arm** and **mechanical arms** with surgical instruments mounted on them. The surgeon controls the robotic arms from a computer console placed near the operating table. The console gives the surgeon an **enhanced, high-definition, three-dimensional view** of the surgical site.

According to Data Bridge Market Research, the market is expected to grow at a **compound annual rate of 18% between 2023 and 2030**².



Source: AXA IM. Cirugía robótica.

Main pros

Remote patient monitoring

Predictive detection reduces the need for surgery and treatments

Better and faster patient care

Greater precision and lower risk

Automotive industry

"We're going to see more change in the next five to 10 years than we've seen in the last 50." Mary Barra, CEO of General Motors*.

Although there are some years to go before driverless cars, trucks and buses become widespread, the truth is that **autonomous vehicles are a reality**. For example, in Phoenix, Arizona, you are more likely to be picked up by a driverless taxi than by one with a human driver.

The global market for autonomous vehicles was valued at 45³ billion dollars in 2022 and is projected to reach 374 billion dollars in 2032, i.e. estimated **compound annual growth of 23.5%**³ in the period.



Source: Bank J.Safra Sarasin. Imagen tomada el 18/11/23.

Main pros

Fewer road accidents

Lower maintenance and repair bills

Greater comfort and more free time

Road decongestion and care for the environment

1 Source: <https://www.marketsandmarkets.com/Market-Reports/collaborative-robot-market-194541294.html>
 2 Source: https://www.databridgemarketresearch.com/es/news/global-surgical-robots-market?srsltid=AfmBOopTurz866KavePVqw2UwwPzzveA_eWY8XJxq8J1wni5O33sL2ev
 3 Source: <https://www.businessresearchinsights.com/es/market-reports/toc/autonomous-vehicles-market-106395>

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