

The Robotics & Automation Industry in Germany

ISSUE 2022

Germany's robotics and automation (R&A) industry has enjoyed unprecedented success over the last decade or so, almost doubling turnover in the period 2010 to 2019. The first signs of post-coronavirus recovery are being felt, with the sector forecast to generate turnover of EUR 13.4 billion in 2021.

Europe's Robotics and Automation Technology Hub

Germany is one of the five major markets for industrial robots. The robotics and automation (R&A) sector in Germany is set to generate turnover of EUR 13.4 billion in 2021 according to the VDMA Robotics + Automation association. This turnaround in post-Covid 19 crisis fortunes is being driven by the resumption of investments postponed during the pandemic and demand for climate-friendly R&A technologies. As order books continue to fill up and momentum returns to the sector, the record results achieved in 2018 will be surpassed in 2022 if current supply bottlenecks for key components can be effectively overcome.

Tomorrow's Robotics and Automation Technologies

The R&A industry is one of the most innovative in the German mechanical engineering sector. German OEMs number among the world's leading R&A companies. Human-robot collaboration (HRC) and machine vision (MV) technologies are considered major strengths in a global hub that boasts robotics players from all market segments. Machine vision counts as one of the major growth sectors in the R&A industry and has become the key technology for the automation industry worldwide. The increasing application level of HRC represents a perfect example of the move towards connectivity within advanced manufacturing. Technological developments in the field of artificial intelligence including machine learning and deep learning will lead to further applications of conventional industrial robots and collaborative robots.

→ Visit our website: www.gtai.com/machinery

The R&A Industry in Numbers

371 industrial robots

per 10,000 employees in Germany – highest density level in the manufacturing industry in Europe and fourth in global comparison

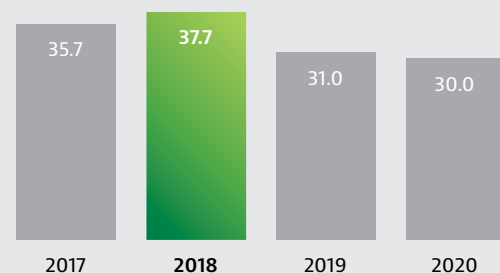
3 million

industrial robots operating in factories around the world

EUR 499 billion

forecast world market for industrial and non-industrial robots in 2025

Annual Supply of Industrial Robots in Germany in thousand units



Source: Statista 2021, International Federation of Robotics (IFR) 2021

MARKET OPPORTUNITIES

Innovative R&A Sectors

Industry Segmentation

According to VDMA classification, the R&A industry can be divided into three innovative sectors: robotics, integrated assembly solutions and machine vision technologies. The VDMA R + A Association represents 280 companies.

- **Robotics**

The robotics industry can be divided into two categories: industrial robots and service robots. Industrial robots represent the core of automation in production technologies. However, service robots are also gaining increasing importance in the market. The robotics sector is expected to recover with 15 percent growth in 2021 after a 23 percent pandemic-related decrease in the previous year.

- **Integrated Assembly Solutions**

The integrated assembly solutions sector mainly focuses on the creation of new hardware and components needed for tasks such as forming, measuring and testing. The sector is forecast to bounce back from a 20 percent downturn last year with 10 percent growth in 2021.

- **Machine Vision Technologies**

Machine vision systems allow machines to see and comprehend. Application fields are diverse and include areas such as components identification, quality control and data collection. The sector was relatively unaffected by the Covid-19 crisis, recording EUR 2.6 billion turnover in 2020.

Machine Vision

Automation and the implementation of machine vision (MV) technology help make consistently high quality, permanent traceability and 100 percent production accuracy a reality. High levels of production flexibility can be achieved and product changes quickly realized using efficient automation solutions. Germany is the most important sales market for the European image processing industry, with more than 30 percent of total industry turnover generated domestically.

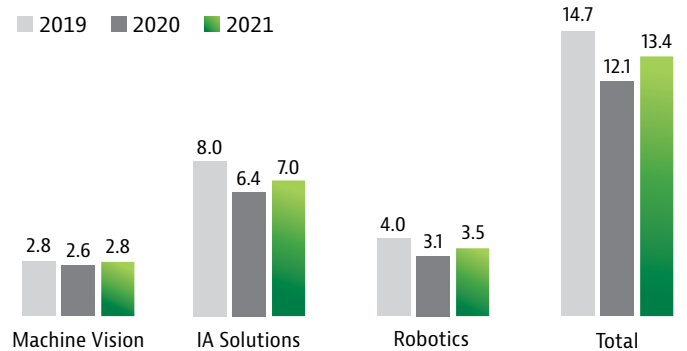
The machine vision industry in Germany – and Europe – has been growing at a fast rate over the past decade, with turnover in the domestic industry doubling during the period 2008 to 2017. Beyond the automotive industry and the electrical and electronics industries (including semiconductors), other sectors – including the metal, food, and packaging as well as non-manufacturing industries (e.g. intelligent traffic technology, medical diagnostic equipment and surgical technologies) – are increasingly making use of machine vision technology. Machine vision plays a pivotal production optimization role in Industrie 4.0 thanks to its peerless data gathering and analysis capabilities.

Service and Assistance Robots

The global market for professional service robots increased by 12 percent to USD 6.7 billion in 2020. Germany has the fourth-highest density of service robot suppliers (after the USA, China and Japan), with Europe accounting for 47 percent of the world's service robot suppliers. The service robot sector is growing at a fast pace, providing space to new companies developing innovative service robot applications or improving existing concepts. Eighty-two percent of the world's service robot suppliers are SMEs. One in every three professional service robots sold in 2020 was made for the transportation of goods and cargo, with segment growth up by 11 percent.

R&A Turnover Development in Germany

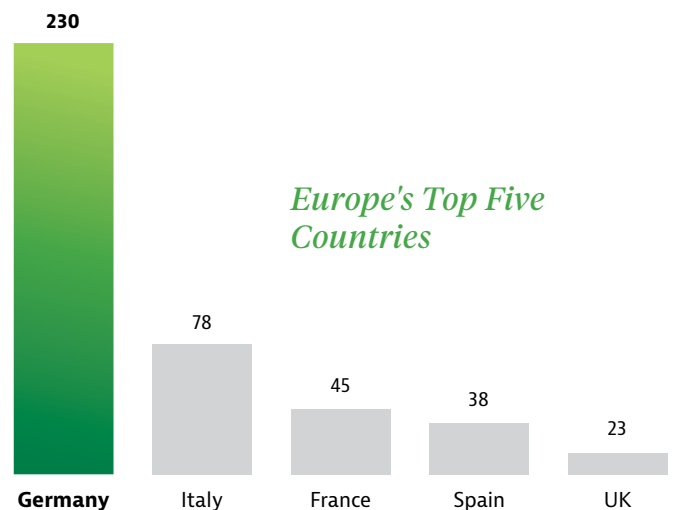
in EUR billion



Source: VDMA 2021

Industrial Robot Operational Stock 2020

in thousand units



Source: IFR 2021

INDUSTRIE 4.0 and Cobots

Industrie 4.0 has become an international by-word for intelligent, networked production – with Germany consolidating its reputation as the world's factory outfitter and a country capable of meeting the challenges of the digital age. Collaborative robots ("cobots") complement production in smart factory environments and make digital manufacturing affordable for SMEs not previously able to afford turnkey solutions.

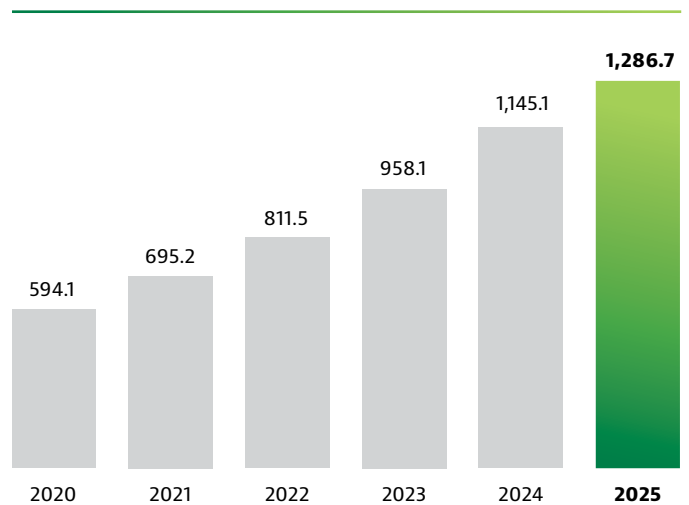
R&A technology provides the core elements for the shift towards Industrie 4.0. Collaborative robots support human labor by automating repetitive and physically demanding tasks. They can be used for diverse applications in modern production sites and no longer require cages. Pick-and-place solutions represent one typical area of cobot activity. Human-robot collaboration activities facilitate quick training and can be controlled via platforms that allow robots to be deployed at the appropriate workstation and the workload to be increased or decreased subject to changing production requirements.

Within Germany alone, projected sales of more than 71,000 cobot units are forecast for 2025. Human-robot-collaboration is increasingly being adopted. According to the International Federation of Robotics (IFR), cobot sales increased by six percent from 2019 to 2020. Cobots have a market share of 5.7 percent among all installed industrial robots worldwide, with the sector very much still in its infancy. Market analyst market-andmarkets predicts a compound annual growth rate of more than 43 percent in the collaborative robot market for the period 2021 to 2027.

Application Segments

The automotive industry is the leading client sector for industrial robots in Germany. According to the VDMA, the automotive industry – and its suppliers – are investing in electric and hybrid drive technologies that insist upon new production processes and equipment, particularly in the area of battery production. The second largest client industry is the electrical and electronics sector. Beyond big industry, many SMEs are now looking at industrial robot implementation as a solution to increase production system flexibility.

Global Collaborative Robots Market Forecast in USD million



Source: IFR 2021

Collaborative Robot Systems Regulations

A number of standards, rules and regulations have been established in Europe to provide practical guidance to cobot manufacturers, system integrators, users, and other interested parties.

Collaborative robot systems...

- comprise the cobot, the robot arm-adapted tool used to perform tasks (and objects moved by it), workpieces, and devices that constitute machinery according to the EC Machinery Directive 2006/42/EC;
- are subject to the EC Machinery Directive and require an EC Declaration of Conformity and CE Mark before being placed on the market;

- safety standards are defined within the revised EN ISO 10218 standards 1 and 2 as well as the ISO/TS 15066 specification;
- require a collision risk assessment that covers the industrial workplace in accordance with the two standards outlined above and the EC Machinery Directive.

Legal requirements, standardization and safety requirements for manufacturers and operators – GTAI brings you in contact with all of the relevant partners, associations and service providers. Contact request@gtai.com

Supporting Business Success

A Tradition of Engineering Quality

German R&A industry strength is driven by a combination of Germany's proven engineering tradition, its position as a leader in technological development, and its highly diversified industrial base. The machinery and equipment (M&E) industry is one of the technological motors that drive Germany as a high-tech nation combining all of the key future technologies, such as materials, electronics, software, and robotics: Researchers, companies and employees active in the R&A industry profit from the country's reputation and global know-how. The "Made in Germany" quality seal has long been recognized as a sign of engineering excellence and precision across the globe.

Europe's Leading R&A Investment Location

Germany was Europe's leading FDI destination country for R&A investments during the period 2015 to 2020 according to research conducted by Germany Trade & Invest's FDI Competence Center. The country is similarly the continent's leading destination country for M&E inward investment, with R&A investment projects accounting for 20 percent of all M&E direct investment. More than 150 FDI projects in the R&A sector were made in Germany during this five-year period, with the top source countries being the USA, Switzerland, Japan, and China in that order.

Supporting Digital Platforms – PAiCE

Germany actively supports the use of new digital technologies within the industry as part of its High-Tech Strategy. The PAiCE program provides funding of EUR 50 million over a five-year period for the development of digital industry platforms as well as collaboration between companies making use of these platforms. Major application areas include the creation of platforms for service robotics solutions in the service, logistics, and manufacturing sectors.

Generous Public Incentives

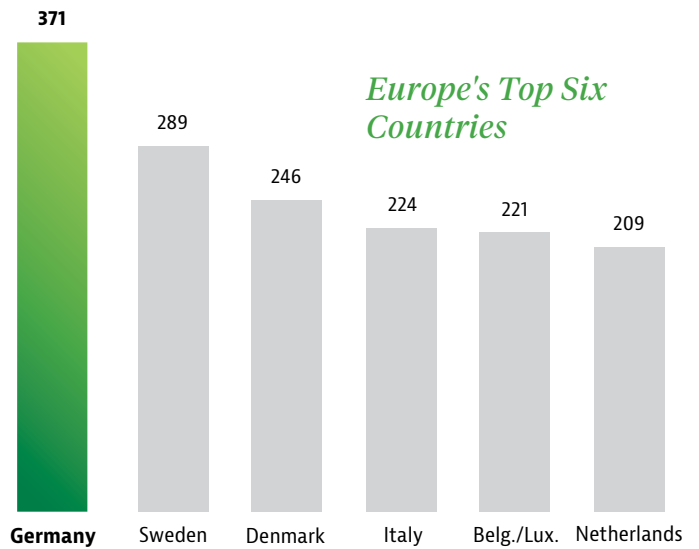
Germany offers numerous incentives for all investors – regardless of country of provenance. There is a large selection of programs designed to support a wide variety of business activities at different stages of the investment process. These range from cash incentives for the reimbursement of direct investment costs to support for research and development and labor.

The High-Tech Strategy

The highly innovative character of the robotics industry makes it an important part of Germany's High-Tech Strategy. This is complemented by other government R&D support programs that provide public grants – either as a reimbursable advance or in the form of a nonrefundable cash grant. As part of the research program on human-technology interaction,

Robot Density in the Manufacturing Industry 2020

Number of installed industrial robots per 10,000 employees



Source: IFR 2021

the federal government will support companies, research institutes and academics with non-refundable cash grants. Within the "Together through Innovation" research program, which promotes interactive technologies for health and quality of life, Germany's Federal Ministry of Education and Research will provide around EUR 70 million annually in grants up to 2026.

Academic Study Programs

Germany provides access to a network of universities highly active in the field of mechanical engineering with a special range of robotics and automation study programs. Around 300 automation and robotics-related study programs are currently available. German industry also enjoys a global reputation for its high R&D activity.

Robotics and Automation R&D

Research and Innovation in Europe

Launched in January 2021, Horizon Europe is the 9th Framework Program of the European Union (EU) for Research and Innovation and the successor program to Horizon 2020. The EU initiative has assigned a budget of EUR 95.5 billion for the period 2021 to 2027. Robotics-related R&D activities will focus on the digital transition in the manufacturing and construction sectors, autonomous solutions, enhanced cognition, and human-robot collaboration. A budget of more than EUR 198 million has been allocated for these activities within the framework of the “Digital, Industry, and Space” cluster.

Clusters, Networks and Research Institutes

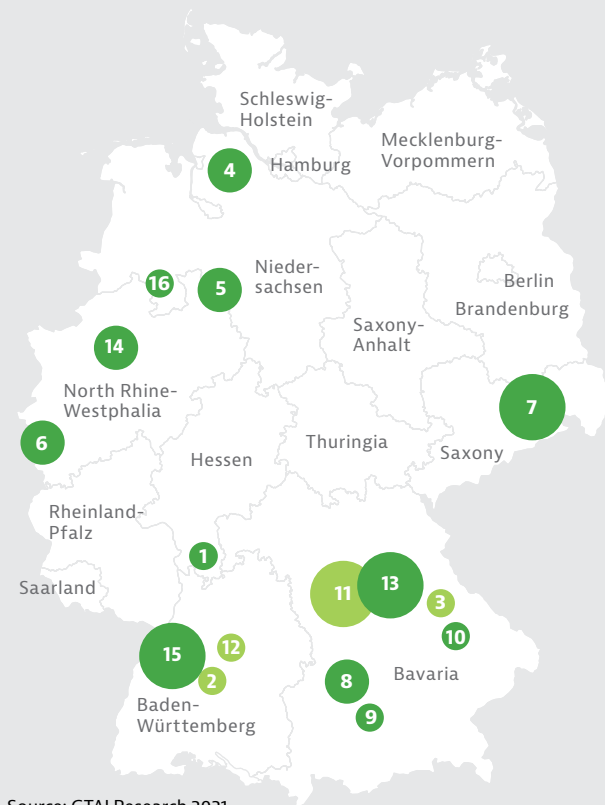
Regional innovation clusters help bridge the gap between science and industry. Stakeholders are organized in multiple regional clusters such as the Automation Valley Northern Bavaria cluster. The country’s specific strength in the development and manufacturing of robotics is further illustrated by the existence of specialized clusters such as the Robotics and Mechatronics Center at the German Aerospace Center (DLR). Several Fraunhofer-Gesellschaft research institutes are also actively conducting research in the areas of automation,

robotics and related fields. These include, inter alia, the Institute for Manufacturing Engineering and Automation (IPA); Institute for Production Systems and Design Technology (IPK); Institute for Factory Operation and Automation (IFF); and the Institute for Intelligent Analysis and Information Systems (IAIS). VDMA R&A has entered into a partnership with andugo working on the latter’s GO2automation platform. The joint objective is to provide SMEs with AI-supported platform networking in automation.

Germany Trade & Invest – A Strong Partner

Germany Trade & Invest provides direct access to all of the relevant actors in the German R&A industry. As the hub for a far-reaching network at both home and abroad, GTAI maintains close relations with all clusters, networks and research institutions. Our industry experts support you in finding project partners for your research project in special and new robotics application fields. Germany’s modern research infrastructure and the expertise of university and non-university research institutes are also at your disposal. Germany Trade & Invest also helps identify relevant funding incentives options for establishing your research facility in Germany.

Selected Robotics and Automation Clusters and Networks



Source: GTAI Research 2021

Selected Clusters and Networks

- 1 Automatisierungsregion Rhein Main Neckar e.V.
- 2 Intralogistik Netzwerk in Baden Württemberg e.V.
- 3 Kompetenz Netzwerk Mechatronik in Ostbayern
- 4 Composites United e.V. (CU)
- 5 it's owl
- 6 REGINA e.V. – Regionaler Industrieclub Informatik Aachen
- 7 Silicon Saxony e.V.
- 8 Cluster Mechatronik & Automation e.V.
- 9 Robotics and Mechatronics Center at the DLR
- 10 Strategische Partnerschaft Sensorik e.V.
- 11 Automation Valley Nordbayern
- 12 Allianz Industrie 4.0 Baden-Württemberg
- 13 Forum MedTech Pharma
- 14 Digital Hub Logistics
- 15 BIOPRO Baden Württemberg
- 16 Agrotech Valley

Clusters

- Small cluster (<85 member companies)
- Medium-sized cluster (85-200 member companies)
- Large cluster (>200 member companies)

Networks

- Small network (<85 member companies)
- Medium-sized network (85-200 member companies)
- Large network (>200 member companies)

Our Support for Your Business in Germany

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Our Investor Consulting division of specialist industry teams provide international investors in all sectors with comprehensive consultancy services specific to each individual investment project. Services include:

- Market and industry reports
- Market entry analyses
- Business and tax law information
- Funding and financing information

All investment-related services are provided entirely free of charge and all enquiries are treated with the utmost confidentiality.



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