

# The Robotics & Automation Industry in Germany

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**Germany's robotics and automation (R&A) industry has enjoyed unprecedented success over the last decade, recording average annual growth of 10 percent and almost doubling turnover in the period 2010 to 2017. The sector generated record turnover of EUR 14.5 billion in 2017, with revenue of more than EUR 15 billion forecast for 2018.**

## Global Market Growth

According to the International Federation of Robotics (IFR), global industrial robot sales reached record levels in 2017 – with the international market value for robot systems estimated at around USD 40 billion. The IFR forecasts that robot installations will have a compound annual growth rate of at least 15 percent during the period 2018 to 2020. It is also estimated that more than 1.7 million new industrial robots will be installed in factories around the world by 2020. The global trend towards automation and digitalization in the manufacturing sector is providing continuous growth momentum. Accordingly, the world market for industrial and non-industrial robots is forecast to rise to EUR 499 billion in 2025 according to market analyst Tractica.

## Europe's Robotics and Automation Technology Hub

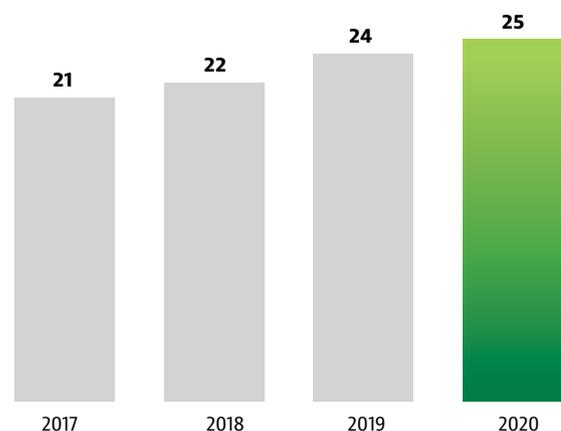
With a workforce of almost 53 thousand people, Germany's robotics sector boasts a robot density level of 309 industrial robots per 10 thousand employees. This gives the country the highest density level in Europe and puts it third in global comparison (global average of 74 robots per 10 thousand employees). Between 2018 and 2020, domestic annual supply will continue to grow by at least five percent on average per year thanks to demand for robots in industry in general and the automotive industry in particular. According to the German Mechanical Engineering Industry Association (VDMA), the sector has an export share of 60 percent, with China representing the largest single overseas market (14 percent export share).

## 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 boast 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.

## Estimated Annual Supply of Industrial Robots in Germany 2017-2020

in thousand units



Source: IFR 2017

## MARKET OPPORTUNITIES

# Main Application Industries

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.

### VDMA Classification

According to VDMA classification, the industry can be divided into three innovative sectors.

- **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.

- **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. With 25 thousand employees, integrated assembly solutions describe the biggest sector within this industry.

- **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.

### Machine Vision

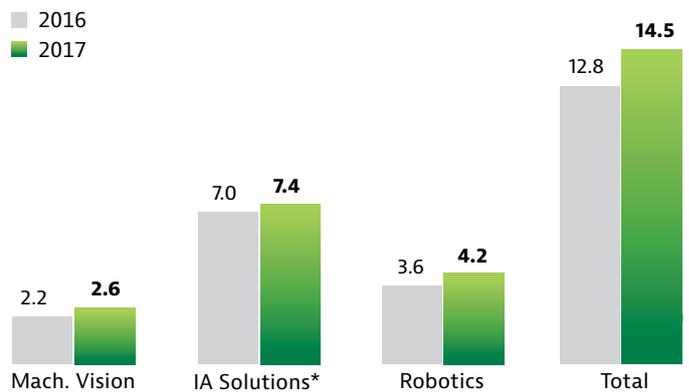
Automation and the implementation of MV technology help make consistently high quality, permanent traceability and 100 percent production accuracy a reality. High levels of production flexibility can be achieved and product changes quickly realized using efficient automation solutions. Germany is the most important sales market for the European image processing industry, with more than 30 percent of total industry turnover generated domestically. In just a decade, MV industry turnover has more than doubled. Record turnover of EUR 2.6 billion was reached in 2017 (18 percent increase), with dynamic market development set to be maintained in 2018 (forecast annual turnover increase of 10 percent).

Beyond the automotive industry (20 percent of total turnover) 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.

### Robotics and Automation Turnover Development in Germany

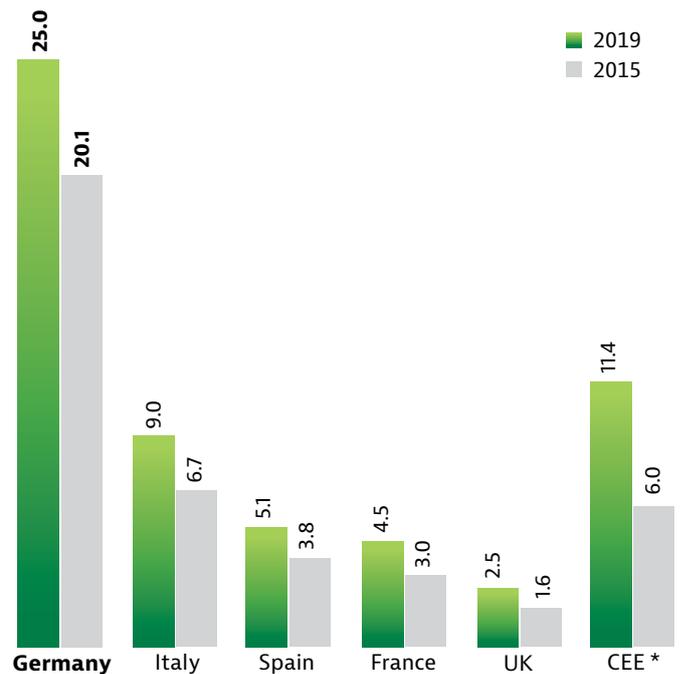
in EUR billion



\* IA Solutions: Integrated Assembly Solutions  
Source: VDMA 2018, Statista 2018

### Estimated Yearly Shipments of Multipurpose Industrial Robots in Selected Countries

number in thousand units



\* CEE: Central/Eastern Europe  
Source: IFR 2016, national robot associations 2016

# Innovative Application Areas

## INDUSTRIE 4.0 and Cobots

R&A technology provides the core elements for the shift towards Industrie 4.0. Collaborative robots ("cobots") 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. HRC 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, around five thousand cobots are expected to be sold in 2018. Current market forecasts expect cobots to represent around 34 percent of the global robotics market up to 2025.

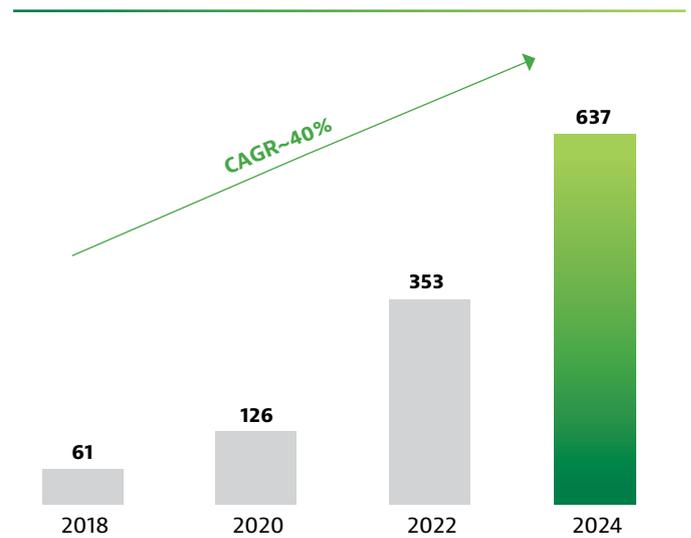
## Service and Assistance Robots

Service and assistance robots are one of the major growth sectors in the automation industry, with German robot manufacturers counting among the world's service robotics pioneers. According to the IFR, service robot for professional use turnover for 2017 saw an increase of 12 percent, generating record revenue of USD 5.2 billion. Cumulative volume in the USD 27 billion region is forecast for the professional service segment during the period 2018-2020. Medical robots and logistics systems are established service robot client sectors with considerable double-digit growth potential. In the logistics sector, autonomous guided vehicles have

great potential to boost Industrie 4.0 flexibility levels with application also seen in the areas of e-commerce and hospital logistics. Industry voices believe that service robot sales could reach the same level as that of industrial robots during the period 2020 to 2025.

## Projected Sales of Collaborative Robots Worldwide 2018-2024

in thousand units



Source: IFR 2017, HMC Investment Securities 2018, Statista 2018

## Collaborative Robot Systems Regulation

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.



More information can be found online at the DGUV website [www.dguv.de](http://www.dguv.de) or contact Germany Trade & Invest's industry experts at [www.gtai.com/machinery](http://www.gtai.com/machinery)

# 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.

## Dual Education System

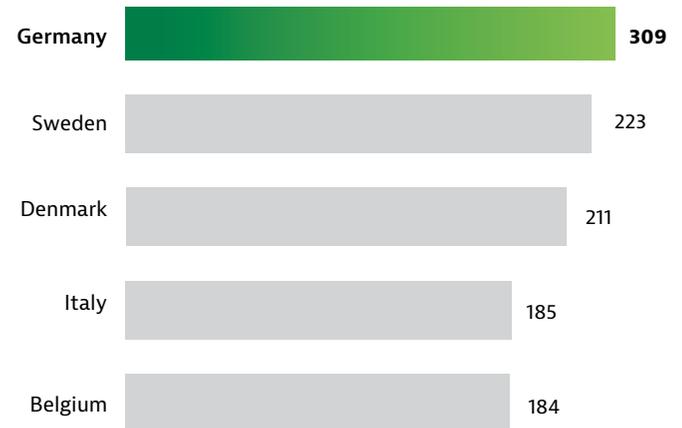
In order to secure the economy's demand for highly qualified personnel, Germany developed a dual system in vocational training – combining the benefits of classroom-based and on-the-job training over a period of two to three years. In close cooperation with the German government, the German Chambers of Industry and Commerce (IHKs) and the German Confederation of Skilled Crafts (ZDH) ensure that exacting standards are rigidly adhered to, guaranteeing the quality of training provided across Germany. One in five German companies take part in the dual vocational training system, thereby turning apprentices into specialists who fit each company's individual needs. Most apprentices receive an employment contract after training. In production-based industries more than 70 percent are taken on as employees, underlining the importance of the training system for companies. More than 1.3 million young people are currently in vocational training in Germany.

## Competitive Labor Costs

High productivity rates and steady wage levels make Germany an extremely attractive investment location. Since 2005, wages in the manufacturing sector have risen in most European countries (EU-28), with the growth rate averaging 2.7 percent. While some countries – particularly those in Eastern Europe – experienced a rise of more than five percent, Germany recorded one of the lowest labor cost growth rates (2.1 percent) in the manufacturing sector within the EU. Highly flexible working practices such as fixed-term contracts, shift systems, and 24/7 operating permits contribute to enhance Germany's international competitiveness as a suitable investment location for internationally active businesses.

## Robot Density in the Manufacturing Industry: Top 5 European Countries

number of installed industrial robots per 10,000 employees 2016



Source: IFR 2018

## Public Incentives and R&D Programs

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 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 non-refundable cash grant. As part of the research program on human-technology interaction, the federal government will support companies, research institutes and academics with non-refundable cash grants of around EUR 70 million each year during the period 2016 to 2020.

## 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.

# World-Class Robotics and Automation R&D

## Europe's Leading R&D Nation

Germany is Europe's leading R&D investment nation. Internationally, only the US, Japan, and China have bigger domestic R&D budgets. Germany is also one of the European leaders in terms of R&D investment as share of GDP, with a 2.9 percent share in 2015 putting it above the OECD 2.4 percent average and the EU-28 average of less than two percent. In 2016, machinery and equipment companies invested EUR 5.7 billion in R&D activities. Germany also has an internationally leading intellectual property role in terms of industrial robot patents.

## Clusters, Networks and Research Institutes

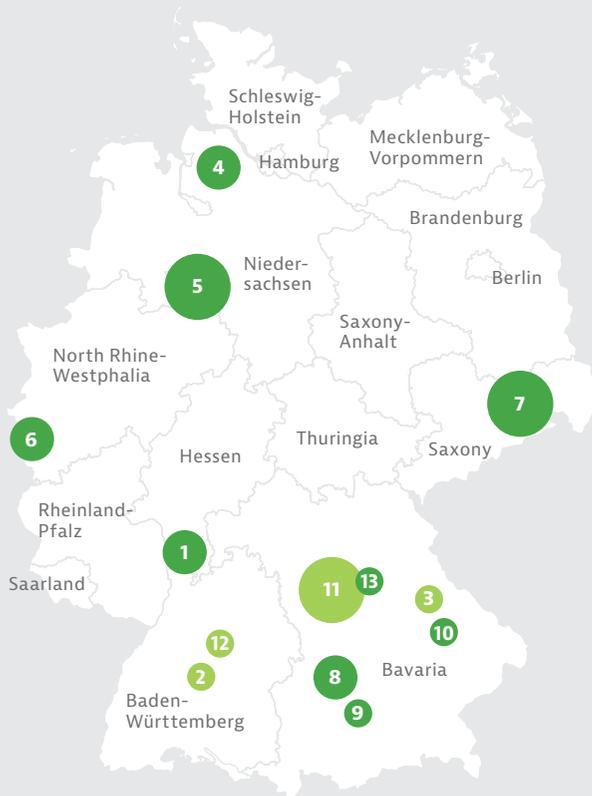
Regional innovation clusters help bridge the gap between science and industry. Stakeholders are organized in multiple regional clusters such as the Automation Valley Northern Bavaria cluster. The country's specific strength in the development and manufacturing of robotics is further illustrated by the 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).

## go-cluster

Launched in 2012, the "go-cluster" excellence program brings together more than 100 innovation clusters from across Germany. The program provides financial stimulus – in the form of support for innovative services and funding for novel solutions – to optimize cluster management allowing German clusters to position themselves as highly effective and visible international clusters. Compliance with go-cluster membership quality criteria also prepares clusters for European Cluster Excellence Initiative silver and gold excellence label certification.

### Selected Robotics and Automation Clusters and Networks



### 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\* CFK Valley e.V.
- 5\* it's OWL – Intelligente Technische Systeme OstWestfalenLippe
- 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

#### 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)

Source: Clusterplattform, GTAI Research 2018, \*go-cluster certified

## OUR SERVICES

# About Us

Germany Trade & Invest (GTAI) is the foreign trade and inward investment agency of the Federal Republic of Germany. The organization advises and supports foreign companies planning to expand into the German market and assists German companies seeking to enter foreign markets.

### Investment Location Germany

GTAI provides close-to-market information to international companies looking to enter German markets. Our specialist industry teams prepare all of the relevant information essential to business success in Germany. GTAI's comprehensive range of information services includes:

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

### Business Location Services

GTAI supports international companies from market entry to business start-up in Germany. Expert project teams advise and assist in the business establishment phase. GTAI's range of free services includes:

- Legal and tax-related project support
- Funding and financing advisory services
- Site visit organization
- Local partner and network matchmaking
- Public and private partner coordination

All investment-related services are provided entirely free of charge. Our specialist industry teams have hands-on experience in their respective industries and treat all investor enquiries with the utmost confidentiality.

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