

Smart Farming in Germany

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Demand for technological advances in agriculture is growing. Smart farming technologies provide solutions to harvest security, natural resource protection and herbicide and pesticide reduction. Digitalization in agriculture is seeing developments made in sensor technologies, robotics, automation, artificial intelligence, and big data.

Global smart farming market

Analysts from Research and Markets estimate the global smart agriculture market at USD 22.4 billion in 2024 and project that it will reach USD 117.2 billion by 2034. For the European market they forecast a CAGR of 18.7 percent during the same ten-year period. The market is expected to grow from just under USD 4 billion in 2024 to USD 22.2 billion by 2034. Drivers of market growth are the rising costs of wages, fertilizers and energy as well as increasing demand for sustainability.

Agriculture in Germany

Germany was Europe's second-biggest agricultural production nation in 2024, with production value of EUR 73.4 billion. Almost half of the country's land mass – 16.6 million hectares – was used for agricultural purposes in 2024. Arable farming accounts for more than 70 percent of land use, followed by permanent grasslands (28.5 percent) and permanent crops (1.2 percent). In 2024, there were 255,000 farms with an average agricultural land area of 65 hectares per farm.

Robotics in agriculture

International Federation of Robotics (IFR) data shows that agricultural robots had a 21 percent year-on-year-growth rate, with almost 20,000 units sold in 2023. Just over 2,000 units of robots used for cultivation and close to 17,600 robots for other agricultural tasks including milking and barn cleaning were sold. Robots-as-a-Service (RaaS) shows an exceptional growth rate of 113 percent, but absolute values are still small with 83 RaaS fleet units. Germany has the highest number of agricultural robotic companies after the US and France.

A strong focus on sustainability and environmental protection within Germany has created increased demand for advanced robotics solutions conducive to precision farming and a reduction of harmful chemical and pesticide use. These and other factors continue to accelerate the adoption of robotics solutions in the agrarian sector.

Smart Farming in Numbers

85.5%

of Germany's farmers use digital technologies
on their farms in 2025

EUR 9.1 billion

domestic market volume for agricultural
machinery in 2023

Number 2

worldwide in digital agriculture patents
in 2025

Number 3

manufacturer of agricultural robots in the world
in 2023 (based on the number of robotics
companies in the country)

Sources: BMLEH 2024; International Federation of Robotics 2025;
European Patent Office 2025

Agricultural Sector in Germany

Germany's agricultural sector has undergone a major structural transformation in recent decades. The number of farms and the size of the workforce are in decline as agricultural product volume continues to rise. Larger farm sizes, increased efficiencies, digitalization, and the promotion of high-yield crops and livestock are driving these developments.

Agriculture industry in transformation

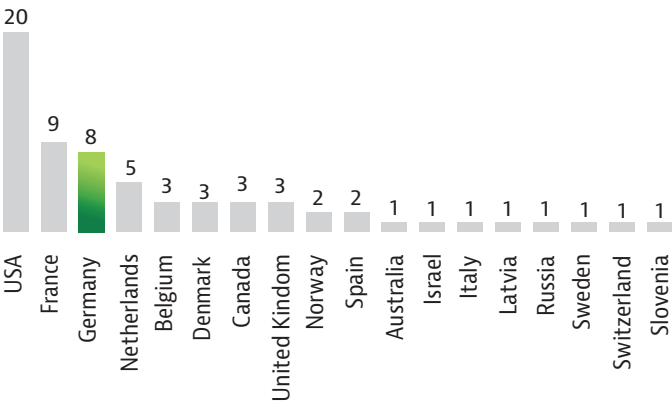
There were around 255,000 farms active in the German agricultural sector in 2024. These typically occupy around 65 hectares of agricultural land area per farm, with small farming businesses most often found in southern Germany. Larger farm operations – with 200 hectares or more – are typically located in the east of the country. The three federal states with the greatest agricultural land use are Bavaria, Lower Saxony and North Rhine-Westphalia. Cattle, pig and poultry production represent the focus of livestock husbandry in the country, with animal products generating around EUR 35.3 billion in turnover in 2023.

Digitalization in agriculture in Germany

According to a study conducted in 2024/25 by the Federal Ministry of Agriculture, Food and Regional Identity (BMLEH), 85.5 percent of respondents use digital technologies on their farms and 9.1 percent plan to invest in new digital technologies within the next 12 months. The greatest benefits that farmers personally perceive on their farms through digital applications are time savings (61.4 percent), greater produc-

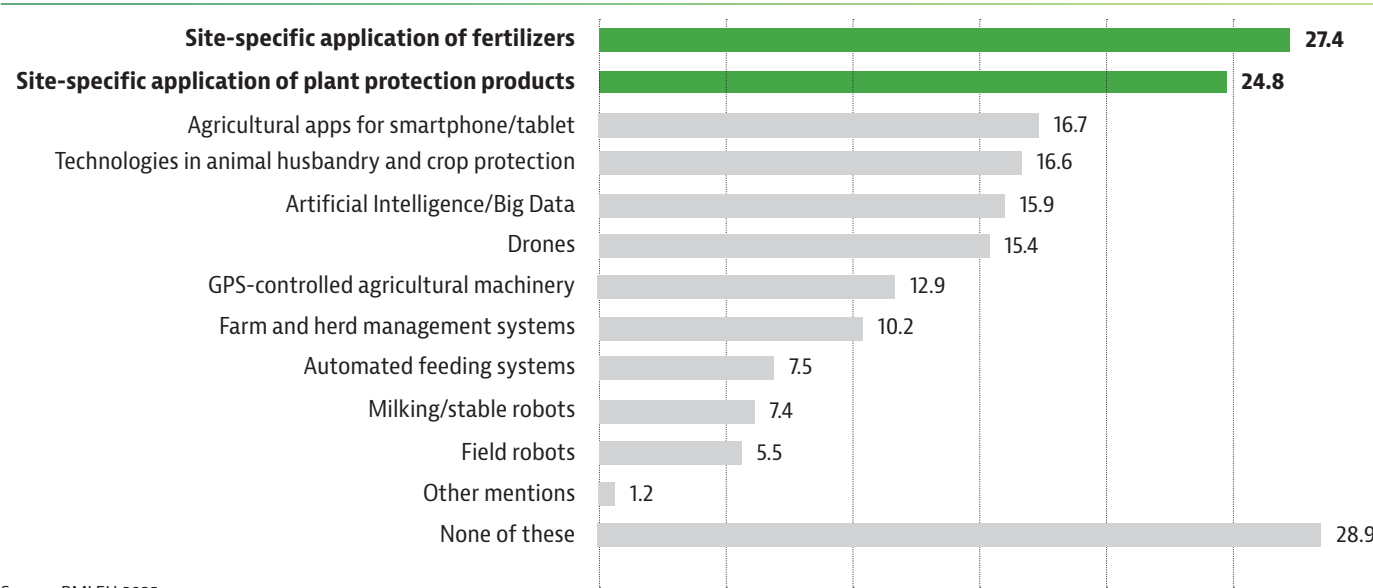
tion efficiency (58.1 percent) and physical relief (50.4 percent). The biggest obstacles are seen as being high investment costs (73.3 percent) and increased bureaucracy (62.8 percent). Respondents expressed particular interest in precision agriculture, the digitalization of farm management, automated equipment, and sensor technology.

Distribution of Agricultural Robotics Companies by Country of Origin*



*Only ground-based robots are considered. Software-only and drone manufacturers are not included.
Source: International Federation of Robotics 2024

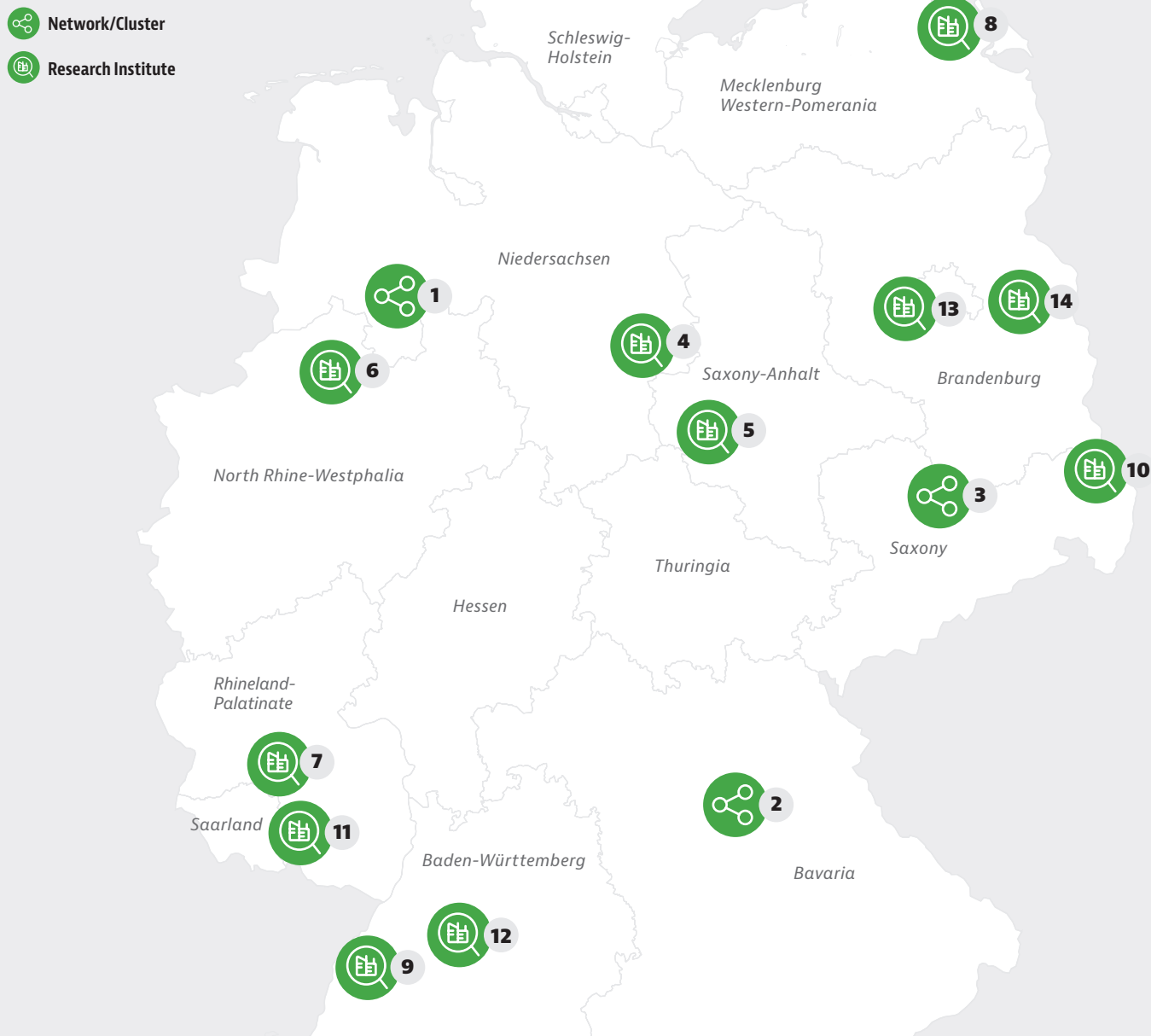
Technologies/Methods Used in Agriculture in percent



Source: BMLEH 2025

World-class Research & Development

Internationally renowned research institutes are present in agricultural industry clusters distributed across the country.



SELECTED RESEARCH INSTITUTES AND NETWORKS

Networks/Clusters

- 1** Agrotech Valley Forum e.V.
- 2** Competence Network Digital Agriculture Bavaria
- 3** Agronym e.V.

Research Institutes

- 4** Johann Heinrich von Thünen-Institut - Institute of Agricultural Technology
- 5** Julius Kühn-Institute (JKI)
- 6** DFKI Competence Center Smart Agriculture Technologies (CC SaAT)
- 7** German Research Center for Artificial Intelligence (DFKI)

- 8** Friedrich-Loeffler-Institut (FLI)
- 9** Karlsruher Institute of Technology (KIT)
- 10** Fraunhofer Institute for Transportation and Infrastructure Systems (IVI)
- 11** Fraunhofer Institute for Experimental Software Engineering (IESE)
- 12** Fraunhofer Institute for Manufacturing Engineering and Automation (IPA)
- 13** Leibniz Institute for Agricultural Engineering and Bioeconomy (ATB)
- 14** Leibniz Centre for Agricultural Landscape Research (ZALF)



Find more information on our digital online map at our website.

Location Advantage Research & Development

Germany's world-class R&D institutes are shaping the future of digital farming. A selection of most important institutes and trial fields for smart farming are described below. The numbers correspond to the numbers on the map.

Networks and clusters

International companies active in the digital farming sector enjoy ready access to agricultural technology clusters where farmers, machinery manufacturers, agrotech start-ups, universities, and research institutes work together.

1 2 3 Stakeholders are organized in regional networks like the Agrotech Valley in northwestern Germany, Competence Network Digital Agriculture Bavaria in Bavaria and Agronym in Saxony.

Federal Research Institutes

Germany can count three federal research institutes that conduct research in the field of digital farming. One of their many research areas is the use of digitalization and automation in agriculture.

4 The Thünen Institute conducts research and provides policy advice on rural areas, agriculture, forests, and fisheries.

5 The Julius Kühn-Institut (JKI) is the Federal Research Centre for Cultivated Plants and an autonomous superior federal authority aligned to the Federal Ministry of Food and Agriculture (BMEL).

8 The Friedrich-Löffler-Institut (FLI) focuses on farm animal health and welfare.

Fraunhofer Society

The Fraunhofer Society is one of the leading organizations for application-oriented research. Various Fraunhofer Institutes are driving smart farming forward through digital platforms, AI-supported agricultural technologies, networked sensors, autonomous systems, and automated production processes. Their goal is sustainable, efficient, and data-driven agriculture – from crop production to animal husbandry and aquaculture. They work closely with industry, science and research partners.

German Research Center for Artificial Intelligence DFKI

The German Research Center for Artificial Intelligence (DFKI) "Smart Agriculture Technologies in Osnabrück" (CC-SaAT) competence center brings the DFKI's different agricultural competences together at one site. Working with industry and other research partners, CC-SaAT develops and applies AI technologies in agricultural contexts. The German Research Center for Artificial Intelligence has also initiated the Yield

Consortium as part of its AI4EO Solution Factory in Kaiserlautern. Established in 2021 in cooperation with the European Space Agency, the Yield Consortium makes use of satellite data and AI to forecast agricultural yield.

Federal Research Institutes

Germany can count three federal research institutes that conduct research in the field of digital farming. The Julius Kühn-Institut (JKI) is the Federal Research Centre for Cultivated Plants and an autonomous superior federal authority aligned to the BMLEH. The Friedrich-Löffler-Institut (FLI) focuses on farm animal health and welfare. The Thünen Institute conducts research and provides policy advice on rural areas, agriculture, forests and fisheries. One of the many research areas of the three organizations is the use of digitalization and automation in agriculture.

Leibniz Association

The Leibniz Association connects 97 independent research institutions that conduct basic and applied research in different research areas. The Leibniz-Institut für Agrartechnik und Bioökonomie (ATB) is one of the major agricultural engineering research institutes in Europe. The Leibniz-Zentrum für Agrarlandschaftsforschung e.V. (ZALF) conducts research in the area of sustainable agriculture and digitalization.

Clusters and industry associations

International companies active in the digital farming sector enjoy ready access to agricultural technology clusters where farmers, machinery manufacturers, agritech start-ups, universities, and research institutes all work together. Stakeholders are organized in regional networks like, for example, the Agrotech Valley (northwestern Germany), Agronym (Saxony), and Competence Network Digital Agriculture Bavaria (Bavaria).

Digital trial fields

The BMLEH supports 14 digital trial fields at agricultural operations all over Germany with EUR 70 million funding until 2025. The aim of the trial fields is to help research digital techniques for crop production and animal husbandry as well as to test their practical suitability. Successful technologies and methods should be transferred into agricultural practice and some fields could be continued as regional competence centers. The knowledge from the experimental fields is bundled at www.farmwissen.de and freely available. Since 2022/23, the BMLEH has also supported 12 future companies and future regions with EUR 31 million for a period of three years with the option to extend the projects by two years.

Smart Farming Funding Opportunities in Germany

Germany supports digitalization in agriculture through a number of initiatives and programs. A number of R&D funding programs have been created to promote the development of digital agriculture technologies.

Research and development funding

The Federal Ministry of Agriculture, Food and Regional Identity (BMLEH) and the Federal Ministry of Economic Affairs and Energy (BMWE) have established R&D programs to promote innovation in digitization generally and in the field of smart agricultural technologies specifically. Research and development programs provide up to 70 percent of eligible costs subject to company size and research area.

Interoperability and fair data exchange in agriculture

Eleven collaborative research projects have received around EUR 15.1 million in funding from the BMLEH since 2024/25 in accordance with the "Guideline for promoting interoperability in agriculture for use cases for foreign and domestic trade and along the value chain."

Promotion of innovations in agriculture

The BMLEH subsidize R&D projects for innovations in the German agricultural and food industry. With the German Agricultural Innovation Partnership (DIP), projects can be funded in an initiative procedure that is open to all topics and technologies until they are ready for market. The amount of funding depends on the type of project and amounts to up to 50 percent of eligible costs for industrial research and feasibility studies as well as up to 25 percent of eligible costs for experimental development.

Agricultural start-up support

Agriculture-related start-ups in the early-stage phase can benefit from the BMLEH's program to support young, innovative companies through programs implemented by the Rentenbank, the country's development agency for agribusiness and rural areas. The bank offers subordinated direct loans of up to EUR 800,000 in combination with grants for consultancy services to start-up. The *Rentenbank* also provides indirect capital to start-ups as a limited partner of specialized venture funds. Accelerators like Seedhouse and Rootcamp specialize in the needs of tech start-ups from the agriculture and food sector. They not only provide access to a broad network of start-ups, corporations, universities and research institutes but also offer finance and coaching programs as well as office space.

Bank loans and funding programs

As a business development bank, Rentenbank is an important financing partner for enterprises in the agriculture sector. Companies can request public promotional loans, leasing

financing and guarantees. Financing can be used for a wide range of purposes including investment in digitalization and automation. Access to the different financing options is via the company's main bank. The *Rentenbank* also handles application processing and the funding of the BMLEH start-up and agriculture investment program.

How to Benefit from R&D Funding

To participate in R&D grant programs, companies must define an R&D project with clear objectives and a fixed timeline. Projects should be intended to develop a new product, process or service that substantially surpasses existing products, processes or technical services in terms of their functions, parameters or features. An application for R&D funding also has to set out a commercialization plan, detailing how research results will be transformed into marketable products, processes or services that generate additional turnover and/or employment in the region where the R&D project is located.

R&D Funding Project Examples

DeepFarmBots

The BMWE-funded network "DeepFarmBots – AI-based agricultural robotics for efficient and sustainable agriculture" aims to create new products, processes and services for the use of agricultural robots in various agricultural applications. Particular attention will be paid to the development of technical solutions that can be used across multiple robotic systems.

Agrosystems of the Future

The Federal Ministry of Research, Technology and Space (BMFTR) funded "Agrosystems of the Future" initiative started in 2019 with eight research consortia that are researching and developing future agricultural production systems. The second phase of the project started in 2025 with six inter- and transdisciplinary research consortia on alternative food sources, resource-efficient circular systems, smart and high-tech solutions with artificial intelligence and digital processes for the production of food and feed.

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- Market entry analysis
- Business and tax law information
- Funding and financing information

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