

# ► Project *brief*

Thünen Institute of Farm Economics

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## Networking, knowledge transfer and technology assessment for Horticulture 4.0

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- **Digital pest management, digital crop management and AI-based information management systems as use cases for 4.0 technologies in horticulture**
- **Reduced use of chemical-synthetic pesticides and more efficient production processes as effects on environment and horticultural farms**
- **5G network coverage on the crop fields as a fundamental assumption for Horticulture 4.0**

### Background and aim

Digitalisation and automation have a major impact on horticultural production systems and offer the opportunity to meet the current challenges. To accelerate the integration of these technologies, e.g. robotics, sensor-based solutions and data management systems, in the horticultural sector and thus strengthen the competitiveness of the sector, the German Ministry of Agriculture established from 2019 to 2024 the funding priority Horticulture 4.0. Twelve research and development (R&D) projects and the networking and transfer project HortiCo 4.0 were funded.

## HortiCo 4.0

### ZUKUNFT GARTENBAU

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HortiCo 4.0 aimed to link the actors involved in R&D projects on Horticulture 4.0 in order to promote synergies. Also, HortiCo 4.0 transferred the results into practice and informed the general public to promote adoption and acceptance of 4.0 technologies in horticulture.

Recommendations for innovation policies were derived on the basis of a technology assessment of the 4.0 technologies being developed in the R&D projects. Their potential effects on companies, the sector and the society were evaluated and a SWOT analysis on the opportunities of digitalisation for horticulture was conducted.

### Approach

**Networking:** An organizational framework was created to support an intensive networking of R&D projects, to strengthen the exchange of information and experience

between all project participants and to involve actors from outside the Horticulture 4.0 funding programme.

**Knowledge transfer:** A communication strategy was developed and a corporate design conceptualised to successfully communicate the Horticulture 4.0 projects. In collaboration with a media agency the general public was addressed.

**Technology assessment:** Based on guideline interviews with experts from the twelve R&D projects, potential effects of the 4.0 technologies on companies, the sector and society were analysed. The assessment was completed by a SWOT analysis on the current strengths and weaknesses of horticulture and the opportunities and risks of 4.0 technologies for the specific horticultural branches.

### Results

**Networking:** Due to the corona pandemic, the 2020 kick-off event had to take place virtually. Face-to-face events could only be held in the following years: the 'Network Days' (2021 and 2022) and the 'Forum Zukunft Gartenbau' (2023). It became clear that personal contacts are essential for good networking and an intensive professional exchange between the stakeholders.

**Knowledge transfer:** For the corporate design a claim with the message 'Zukunft Gartenbau' (Future horticulture) was developed. Various information channels were used to transfer information about the R&D projects to horticultural professionals, e.g. trade journals, consultant conferences, trade fairs and a website. The general public was addressed via Instagram (@zukunft.gartenbau) with almost 200 followers and via press releases for print media. Despite support from a media agency, the latter proved difficult to place; only one project with a seasonal reference to Christmas was presented in various regional media.



**Figure 1:** Coordination locations of the twelve R&D projects and HortiCo 4.0 in the 'Horticulture 4.0' funding programme (Source: DLR Rheinpfalz/Mariska Schäffer)

**Technology assessment:** To gain insights into technology's impact three thematic use cases were identified from the twelve R&D projects: (1) Digital pest management, (2) Digital crop management, and (3) AI-based information management systems.

It is expected that the use of these 4.0 technologies has very different, predominantly positive effects on sustainability and the environment, in particular a reduced use of chemical-synthetic pesticides. Production processes could become more efficient, e.g. pest monitoring, fertilisation and irrigation or the documentation of production operations. Strenuous and monotonous labour could be eliminated and partly replaced by higher-value work. However, growers would have to be willing to invest in new and relatively unknown – and thus risky – technologies. Acceptance and willingness to use the technology by the labour force are also required for successful adoption. In addition, in the population safety concerns might arise and have to be considered when using autonomous systems in horticulture.

## Recommendations

To implement the 4.0 technologies in horticultural practice the HortiCo 4.0 team recommends the following:

**Designing the research environment.** As soon as 4.0 technologies are ready for practical application, model and demonstration projects, e.g. an 'Experimentierfeld Gartenbau' (Horticultural experimental field) or a 'Zukunftsinitiative Digitalisierung' (Future initiative digitalisation), should be established to support their implementation in practice. More intensive cooperation between different research disciplines and institutions as well as modular research projects that build on each other could increase research efficiency.

**Strengthening education and knowledge transfer on 4.0 technologies.** The use of 4.0 technologies requires additional technological skills and new qualifications by experts and managers. Thus, of key importance is the capacity building for teaching and counselling staff, which is in the competence of the federal states. 'Digitale Innovationshöfe' (Digital innovations centres) of different locations across Germany. Competence networks for digitalisation could give advising support to farm management.

**Simplify the management of digital data.** Public data should be made available in digital formats, e.g. historical weather data and information on pesticide approvals. Enabling the combination of data from different (public) sources could generate significant added value for the horticultural sector. Safety and risk management measures are important, since the functioning of digital systems is vulnerable in case of internet disruptions or system crashes. Thus, failure and cyber security is very important, including the hybrid use of online and offline applications.

**Creating a legal and technical framework.** The comprehensive 5G network coverage and the expansion of fibre optics in rural regions are essential requirements for the use of 4.0 technologies in horticulture. To protect people and ensure efficient work when using drones, autonomous platforms, or lasers, liability issues for personal injury and property damage have to be clarified, safety systems to be defined, and occupational health and safety regulations to be updated. Furthermore, standardised IT system interfaces and standards for physical interfaces should help to easily connect different systems with one another.

## Further Informationen

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### Partners

- 2 Leibniz-Institut für Agrartechnik und Bioökonomie e. V.
- 3 Technische Universität Braunschweig
- 4 LVG Heidelberg
- 5 DLR Rheinpfalz

### Publications

Ludwig-Ohm S, Dirksmeyer W (2024)  
Schlussbericht zum Verbundprojekt:

Vernetzung, Synergien und Transfer im Gartenbau 4.0 (HortiCo 4.0) – Teilprojekt 1. 76 p

Ludwig-Ohm S, Hildner P, Isaak M, Dirksmeyer W, Schattenberg J (2023)  
The contribution of Horticulture 4.0 innovations to more sustainable horticulture. *Procedia Computer Science* 217: 465-477, DOI:10.1016/j.procs.12.242

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