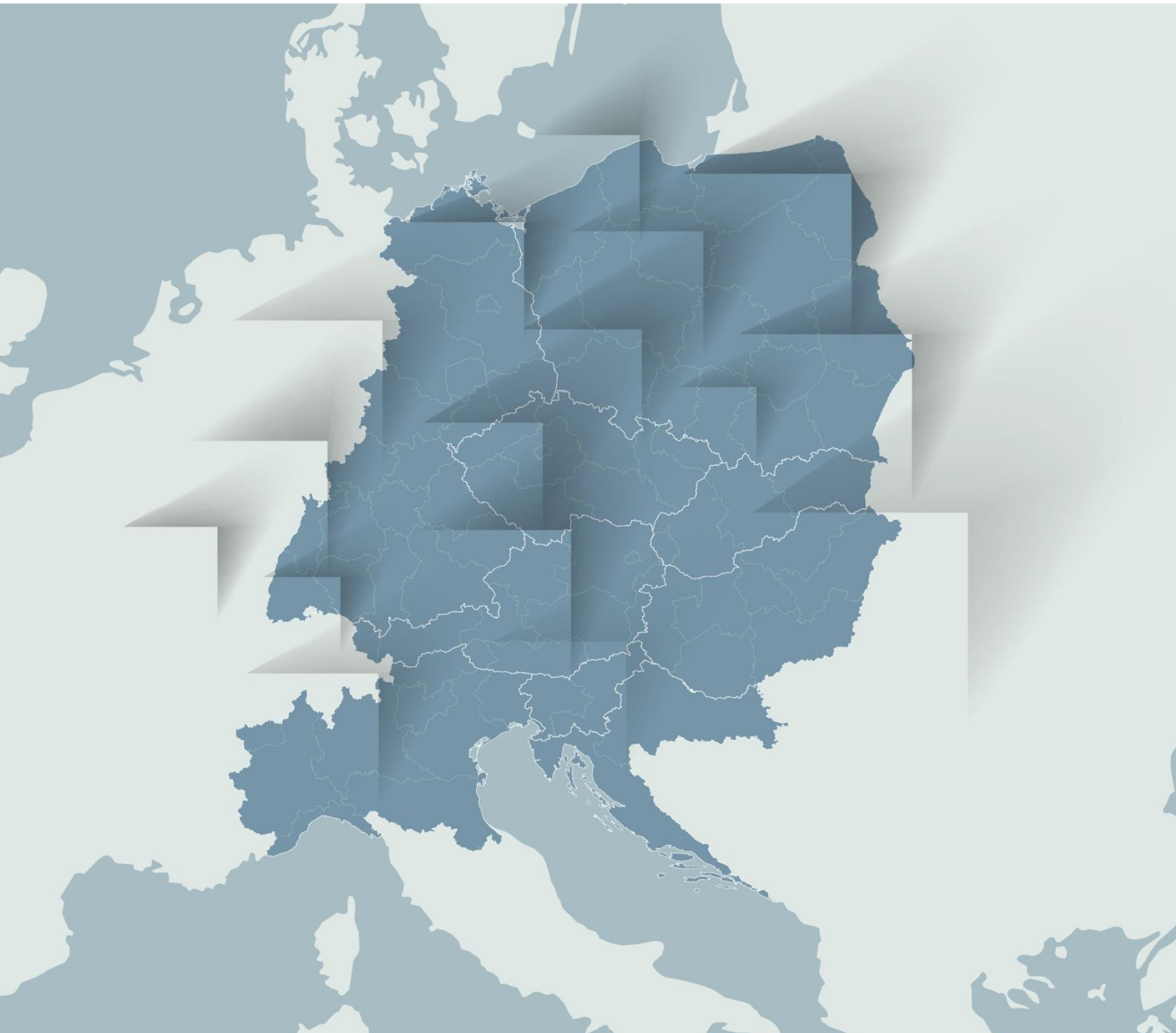
Interreg CENTRAL EUROPE
European Union
European Regional Development Fund

Transfarm4.0

REGIONAL REPORT ON EXISTING REGIONAL INDUSTRIAL EXCELLENCE NODES IN PRECISION

D.T1.2.1 Version 1

Austria 04|2020



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1. Austria

Region: Upper Austria (LCM)[1]

1.1. Overview of regional PA status

Upper Austria hosts top PA companies, e.g., Pöttinger, Steyr Traktoren and Wintersteiger.

Since 2015, *Maschinenring* (https://www.maschinenring.at/) provides a "Real Time Kinematic" (RTK)-Signal for exact driving. Four base stations allow for an area-wide use of this service in Upper Austria. In 2017, about 50 farmers used the MR signal.

Unfortunately, to the best of our knowledge, there do not exist any numbers about the coverage of the use of PA in Upper Austria.

1.2. High-performing OEMs (HW & Equipment), by technology

1.2.1. Steering Systems

The S-Tech System of *Steyr Traktoren* (https://www.steyr-traktoren.com/de-at/landwirtschaft) provides high precision steering with an accuracy of up to 2,5 cm (RTK+). Functions: Automatic turn-around at the end of the track, Vehicle settings logging, Power monitoring, Intuitive Touchscreen Monitor and ISOBUS interface.

The onboard electronics products of *agris* (https://www.agris.at/de/mueller-elektronik/lenksysteme.html) include automatic steering systems with a precision of 15 cm. Their portfolio also includes measuring equipment (humidity, temperature and soil diagnosis) and weighing machines.

1.2.2. Tillage/Soil Cultivation and Seeding Equipment

A major Upper Austrian agricultural technology company that includes grasland care, tillage, seeding equipment and digital farming technology (e.g. driving assistance and precision drill technology) is *Pöttinger Landtechnik GmbH* (https://www.poettinger.at/en_us).

The portfolio of *Einböck* (https://www.einboeck.at) includes machines for crop-care, tillage, grassland care and seeding & fertilizing.

Regent (https://www.regent.at/en/) produces equipment for tilling such as ploughs, power harrows, seed drill gear and cultivators.

[1] provided from: Linz Center of Mechatronics – Researcher DI(FH), Dr. *Martin Scherhäufl*, et.al (2020)

1.2.3. Plant Breeding & Research

WINTERSTEIGER (https://www.wintersteiger.com/de/Home) is the world's number one in field research equipment and has established itself at the top of a niche market which will continue to gain significance in future. The big challenge faced by agronomists and plant breeders is introducing new developments that make a decisive contribution towards sustainable food and energy supplies for the world.

WINTERSTEIGER supplies the technology needed to do this, and its products in this area cover the entire cycle of field research from the sowing to the harvesting. The product range includes: plot combines, plot increase combines, stationary threshers, plot forage harvesters, plot seeders, software solutions for data collection and evaluation, fertilization and crop protection equipment, laboratory equipment.

1.2.4. Animal Monitoring

Smartbow (http://www.smartbow.com/en/home.aspx) developed a comprehensive system for dairy cow monitoring including Industry-leading rumination monitoring, unparalleled heat detection, truly real-time localization and Animal Pattern Recognition IntelLigence (APRIL).

Benefits: Efficient labor management & Time savings, better insights on dairy cow heat and health, and thus better decision. Results: Potentially achieve more milk, better reproduction, lower disease incidence and better milk quality.

1.3. High-performing service providers, by service

Landwirtschaftskammer OÖ (https://ooe.lko.at/) is the legal representation of farmers and lumberjacks in Upper Austria. This institution provides farmers with information, consulting and all kinds of events.

Maschinenring (https://www.maschinenring.at/leistungen/agrar/rtk) is an association that includes agricultural entities which jointly use agricultural and forest machines, and that arranges for agricultural manpower when needed.

1.3.1. High-performing research bodies, by typology

The *University of Applied Sciences Upper Austria* (https://www.fh-ooe.at/campus-wels/studiengaenge/bachelor/agrartechnologie-und-management/alle-infos-zum-studium/schwerpunkte/) offers a bachelor study in agricultural technology and management

Focal points:

- agricultural sciences
- agricultural technology
- agricultural management

Topics:

- technology (amongst others: electrical engineering, sensor technology, digitization)
- plants (amongst others: tillage, greenhouses, precision farming)
- animals (amongst others: anatomy, breeding, precision livestock farming)
- management (amongst others: business administration, agricultural markets, digital marketing)

Certificates:

- agricultural skilled worker
- crop protection expert
- drone pilot

1.3.2. Overview of existing networks

The *OÖ Bauernbund* (http://ooe.bauernbund.at/netzwerkagrar/) offers agricultural networks (Netzwerk Agrar), where all persons can become members. Aim of the networks is to provide amongst others the following services:

- exchange of experience and information
- interface to politics, business and stakeholders
- lectures, excursions, and events

The *Bauernnetzwerk* (https://www.bauernnetzwerk.at/startseite/) is a service platform for farmers and consumers. Aim of the network is to provide amongst others the following services:

- networking
- provide services to farmers and consumers

Region: Lower Austria (HBLFA-FJ)[2]

1.4. Overview of regional PA status

Lower Austria hosts PA companies, e.g. Geoprospectors, agXtend (as a sister company of CNHi), Farmdok, Microtronics.

In the trading business of agricultural products the RWA Raiffeisen Ware Austria AG is widely known. It is the wholesale company and service provider of the Lagerhaus cooperatives in Austria.

1.5. High-performing OEMs (HW & Equipment), by technology

1.5.1. Steering Systems

There are no OEMs known in for steering systems in Lower Austria.

1.5.2. Tillage/Soil Cultivation and Seeding Equipment

Lower Austrian companies for tillage and seeding are:

- ***Agri Farm Maschinenbau GmbH***: They build conventional machines for tillage and soil cultivation
- ***APV Technische Produkte GmbH:*** The company started with disc spreaders for grassland and seeding but continuously enlarged the product portfolio with rotary hoes, tine weeders for mechanical weed control, grassland harrows and grassland rollers, pneumatic seeders. The machines are partly equipped with ISOBUS technology. The competence therefore is established within the company.

[2] provided from: HBLFA Francisco Josephinum (FJ) – Researcher DI.Dr. *Jürgen Karner*, DI *Reinhard Streimelweger* LL.M. (WU), DI *Christian Rechberger* (2020)

- ***Geoprospectors*** GmbH: Their product Topsoil Mapper supports the farmer in optimising soil cultivation by measuring the heterogeneity of fields (soil type, water saturation, and compaction using electromagnetic induction). The products are sold via the CNHi distribution channel "agXtend".

1.5.3. Plant Breeding & Research

Farmdok (https://www.farmdok.com/en/) is a startup and Farmmanagement- and Informationsystem that provides digital tools for planning and record keeping in agriculture.

1.5.4. Animal Monitoring

No companies known in Lower Austria

1.5.5. IoT – Internet of Things

Microtronics Engineering GmbH (https://www.microtronics.com/index_en.html) stands for very high quality state-of-the-art products and services in the field of GSM-based M2M data transmission. The product range covers wireless GSM data transmission technology enabling data interchange between devices and machines, mobile data acquisition devices for data collection and data monitoring in the field as well as visual representation and storage of data on a central server.

1.6. High-performing service providers, by service

Maschinenring already operates PF machinery as know how centre.

Agro-Innovation-Labs (RWA and BayWa) provide drone services

LK digital

The Austrian Chamber of Agriculture supports the web-service "LK digital" (www.lkdigital.at). Established in 2017, it is operated by the LFI - Ländliches Fortbildungsinstitut Österreich, which is the continuing education institute. LK digital was set up as an education campaign to prepare information in the field of digitization in agriculture and to create awareness for new ways of crop and livestock production, marketing and management. It comprises a central hub for digitisation in agriculture. Interested persons can access relevant information, independent from time and place by the help of a knowledge platform. There you can find e.g. useful apps for agriculture and forestry, reports from research projects in digitization, monitoring of pest

infestation (European Corn Borer), use of satellite information based application maps, data networking with farm management information systems

1.7. High-performing research bodies, by typology

HBLFA Francisco Josephinum Wieselburg (https://www.josephinum.at/blt.html): Competences in Precision Farming at

- Analyzing and optimizing technical and logistic processes in the field of agriculture
- Computer Vision: Machine vision (image analysis) in agricultural applications such as plants, soil etc.
- Data and Information Sciences in Precision- and Smart Farming
- Develop future Product concepts based on agro-mechatronic systems
- Experimentation and field metrology

Campus Francisco Josephinum of the University of Applied Sciences Wiener Neustadt (FHWN), Study programme **"Agricultural Technology"**:

Focus:

- crop growing and cultivation
- agricultural engineering
- geo-informatics
- agro-mechatronics
- software development
- precision and smart farming

Certificates:

- agricultural skilled worker
- crop protection expert

Austrian Institute of Technology (AIT, Klosterneuburg, https://www.ait.ac.at/en/about-the-ait/): The AIT was partner of the project SafeCon - Safe semi-autonomous convoying and the project RelCon - Safe control of autonomous vehicles. The KIRAS project SafeCon is aimed at developing a technology for the Austrian Federal Army to make army supply convoys semi-autonomous so as to avoid the loss of human lives in hazardous or dangerous situations. The

RelCon (Reliable Control of Semi-Autonomous Platforms) project team will now refine this core technology for autonomous supply convoys to meet the specific requirements of civil disaster scenarios. The intention is to implement the requirements in a simple and inexpensive way, but without compromising on functionality, reliability or safety.

The RelCon project focuses on the integrated use of autonomous vehicles and remote control by teleoperator so as to be able to respond quickly and flexibly to a variety of operational scenarios or conditions. Specifically, the combination of autonomous vehicles and a teleoperator will make it possible to respond appropriately to unexpected events. A robotic system used in a real disaster scenario is expected to respond flexibly to changing and/or unknown conditions and thus prove highly robust in operation. Hence the focus of the RelCon project is on a combination of autonomy and remote control as a means to achieving the high degree of reliability and robustness necessary for use in civil disaster scenarios.

1.8. Overview of existing networks

Ecoplus (the Lower Austrian business agency, https://www.ecoplus.at/about-us/facts-figures/) operates so called Technopoles. One is located in Wieselburg, focusing on Agricultural Technology:

- Support stakeholders and companies (Funding and Project Partners, …)
- Stimulate the cooperation between R&D, economy and education
- Organization of meetings and events for knowledge exchange and project development
- Dissemination of project outputs and results

The common goal is to make the production of food, feed and raw materials environmentally friendly, sustainable and cost-effective. A part of Ecoplus is the **Mechatronic Cluster**. It incorporates Precision Farming technologies provided by the industrial sector.

Platform "Digitisation in Agriculture": To explore and seize new opportunities the platform "Digitisation in agriculture" of the Federal Ministry for Sustainability and Tourism was established in spring 2017. The platform aims to accompany the trend towards digital technologies in agriculture in the large number of areas concerned with an eye to the future. Short-, medium- and long-term measures are to be taken in a way that this trend can be followed and supported and that domestic agriculture which, in international comparison, is rather small-structured, can make good use of it and utilise it adequately. Specific fields of

action have been identified and analysed in a report. They comprise legal framework conditions just as much as economic or environmental aspects and regional development. [https://www.bmnt.gv.at/english/agriculture/Digitization/Digitisation-in-agriculture.html; accessed 22.07.2019]

Nine areas of activity have been identified [BMNT: Bericht "Digitalisierung in der Landwirtschaft – Entwicklung, Herausforderungen und Nutzen der neuen Technologien für die Landwirtschaft"]:

1. Technology in arable farming: The high rate of development offers a huge potential for an improved, precise and optimized production method. Digitalisation is a challenge for small-scaled Austrian farms. They often can´t afford modern technology (ISOBUS, GNSS, section control, telematics, FMIS) for their own farm. The risk of highly rated transparency or the dependency on reliable technology are rated as risks from farmer´s perspective.

2. Technology in livestock farming: The number of semi- or fully-automatic working processes increases, especially in livestock farming. The systems are digitally controlled and acquire or handle external data. The collected data are used for herd management and for optimized feeding. It has to be mentioned that digitalization in livestock farming must not only be a tool for management control, but has to support animal welfare by the help of existing information.

3. Material management: The information along the value chain shall be improved and standardized. One example is the structured digital data exchange for planning and controlling the processes in the Austrian forestry sector. Meanwhile, about 90 % of the Austrian round timber is managed with the standardized FHP file format to enable automatic cross-company data exchange.

4. Business administration and management: The chance of small scaled farms is to take decisions on the basis of relevant data. Therefore the cost accounting has to be linked with farm-management systems. Farmers need the skills to acquire information out of data. An advantage of digitisation is the simplified proof of origin.

5. Ecology: Digital information from soil and fields supports the decision making process in terms of arable farming (e.g. plant treatment, irrigation, demand-driven fertilization) to minimize environmental impacts (e.g. nitrate concentration in ground water, resistance formation among pathogens).

6. Legal framework: The operation of drones in agriculture to acquire field information requires to fulfil several legal requirements. Uniform standards need to be

developed. The permanent storage of data enables Big Data-analysis. From the legal point of view it is relevant that access to data without personal connection enables benchmarks in wide areas. The combination of various data can lead to new KPIs. But farmers might be supervised by third parties (e.g. service providers) when they collect data from the farmer´s fields. They could draw conclusions e.g. from the site-specific yield value.

7. Administration and agricultural statistics: The ownership of data has to be clarified (open-data).

8. Regional development: Austria is still lacking in technical and social infrastructure. The telecommunication systems need to be established and has to cover the agricultural territory.

9. Education and training, consulting: The digital learning objectives have to be integrated in curricula of courses for future farmers. They learn about the utilization of Smart and Precision Farming. Several training opportunities are offered in Austria by the Francisco Josephinum, University of Applied Science Wiener Neustadt and the University of Natural Resources and Life Sciences.

House of digitalization (https://www.virtuelleshaus.at/): The aim of the House of Digitalization is to increase understanding of the significance of digitalization for our (working) lives and our prosperity. It will provide a new creative space where projects can be initiated and implemented. The aim is to provide support for innovative firms, helping them get their ideas onto a commercially viable footing (www.virtuelleshaus.at).

The targets are:

- Accelerated digital transformation for businesses in Lower Austria
- Easy access to research institutions for business enterprises
- Strengthening multi-disciplinary and international research
- Key and demonstration projects
- Raising awareness
- Transforming people’s fears into interest through better understanding

The (virtual) House of Digitalization comprises several floor levels:

1. digiPEDIA: This floor is some kind of compendium for items, terms and definitions regarding digitization. This reference work explains abstract terms and definitions of digitization by means of concrete examples or projects.

2. digiGALERIE: Examples of digital innovation can be presented on this floor, as well as the corresponding companies.

3. digiEVENTS: This event calendar provides an up-to-date overview about digitization events in Lower Austria.

4. digiSKILLS: Companies and institutes can describe their skills, abilities, resources and references. If someone is seeking for a project-partner you can access this floor.

5. digiFIT: Search function for courses and training opportunities related to digitalization. Organizations that offer these types of opportunities are welcome to add them here.

6. digiLAB: New project ideas can be presented here - expecting to find an appropriate project partner.

7. digiCROWD: Service to support the development of new products, services and business models.

8. digiINNOVATION: Service to support the development of new products, services and business models – within a closed format.

9. digiCHECK: online-check of your digital skills (fit4internet)

10. digiFörderung: Compilation of various funding measures from the state of Lower Austria and the federal government that are relevant to the topic of digitization.

11. digiNEWS: Social media news related to the House of Digitalisation.

12. DIHOST: The Digital Innovation Hub East supports small and medium-sized companies in their digital transformation.

1.9. Other federal provinces

AAC – Austrian Agricultural Cluster **(Headquarter in Vienna, https://www.aac.or.at/):**

The Austrian Agricultural Cluster (AAC) is the export-oriented Association of the most innovative Austrian producers of agricultural, food processing and renewable energy technologies.

The company cluster was founded in 1999, within the Export Promotion Program of the Austrian Ministry of Agriculture, Forestry, Environment and Water Management and of the Austrian Federal Chamber of Commerce.

The Austrian Agricultural Cluster currently represents 19 leading companies and organisations covering all segments of the agrifood chain:

- Agricultural Equipment: Bauer GmbH, Cimbra, CNH Industrial Austria GmbH, Pessl Instruments
- Animal Housing: Schauer, Smartbow, Wolf System
- Animal Nutrition: Biomin, DonauSoja
- Breeding Livestock: pig.at – Austrian Pig Breeders Association, IK Pyra – International Competence Center for Cattle Breeding and Dairy Cattle, ZAR - Federal Association of Austrian Cattle Breeders, ÖBSZ - The Austrian Federal Association for Sheep and Goats
- Consulting Services: BOKU Vienna, Wieser Consult
- Food Processing: Berglandmilch, Bertschfoodtec,Bertschlaska, Biomedica
- Know-How: BOKU, IK Pyra, Wieser Consult
- **Smart Farming:** Bauer GmbH, CNH Industrial Austria GmbH, Pessl Instruments, Smartbow

Through the network of qualified companies in various sectors of agriculture, food-processing and renewable energy, the AAC is a partner for integrated agricultural projects including corporate finance combined with European Union subsidy programs. The core competence

lies in the provision of scientific know-how, consulting and latest technologies of leading Austrian companies and organisations.

Lindner (Headquarter located in A-6250 Kundl/Tirol, https://www.lindner-traktoren.at/en/) has been developing and producing tractors and transporters for the alpine and pasture farming industry, cultivated agriculture as well as for municipalities and cities throughout Europe. Various technical innovations allow a very wide range of applications of agricultural machinery. From agricultural use such as farming, mowing, plowing, etc. to special forestry use in the mountains.

Bauer GmbH (Voitsberg, Styria, https://www.bauer-at.com/en): Bauer GmbH (OEM) operates in three main product fields: Irrigation, Slurry Technology and Pipes & Fittings. The company has accumulated expertise for over 80 years based on experience, research and development to become a world market leader in irrigation technology. A mobile irrigation management system "SmartRain", a BAUER GPS-supported application, can calculate and plan the optimal irrigation amount based on the measured soil moisture, the existing soil type and on the weather conditions. The app can be used from any mobile device and offers an overview of the irrigation machines on the field.

Audili (Styria, https://www.audili.io/) is a start-up company which develops a self-learning software which determines soil characteristics on a satellite basis and thus replaces complex soil analyses. Audili utilise proprietary remote soil sensing algorithms in combination with certified third party soil probes to support, verify and monitor the longterm storage of CO2. Based on these results voluntary CO2 certificates are issued and farmers compensated for taking action.