

## REGIONAL REPORT ON EXISTING REGIONAL INDUSTRIAL EXCELLENCE NODES IN PRECISION

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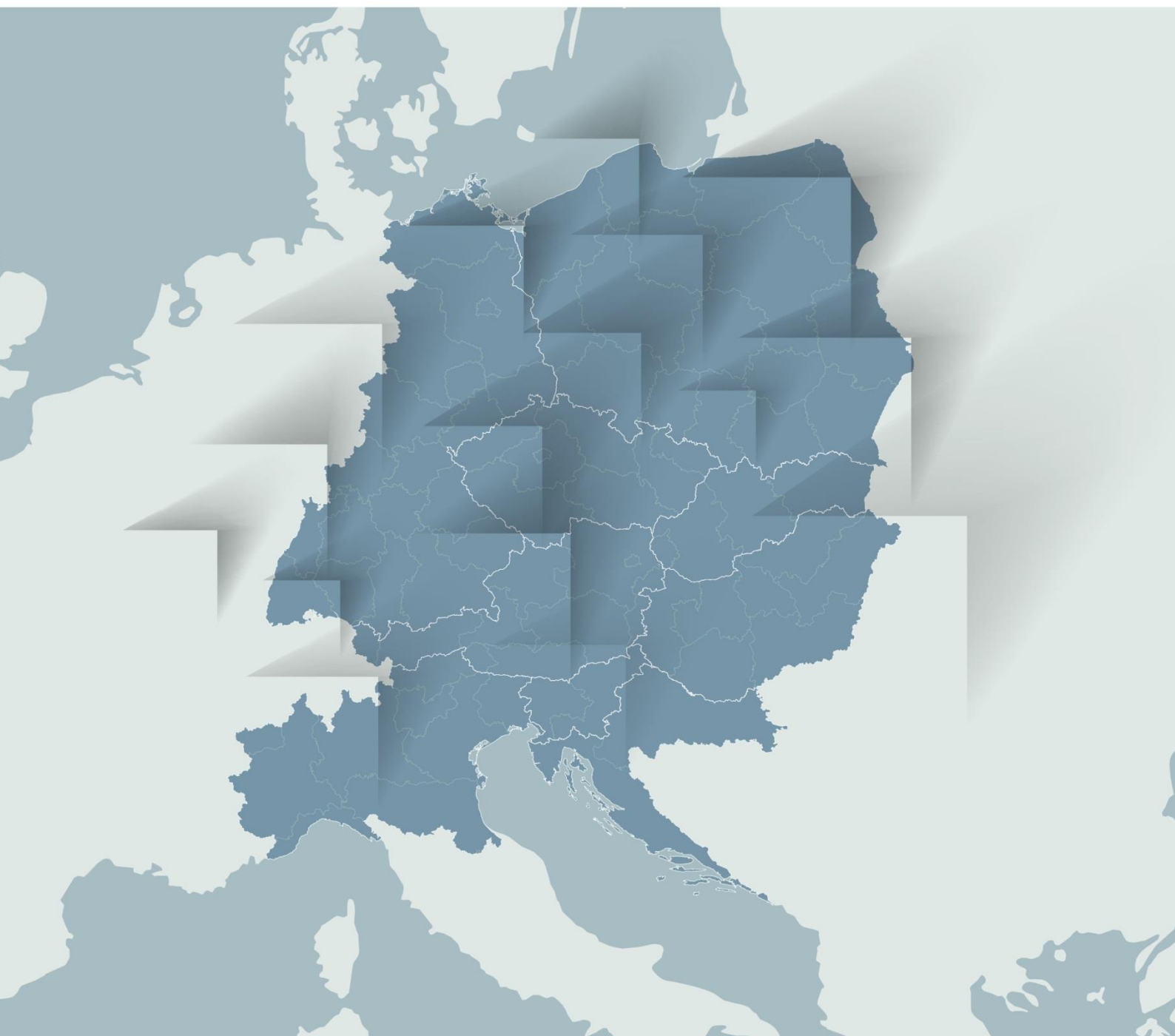
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Slovenia

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## 1. Slovenia<sup>1</sup>

### 1.1. Overview of regional PA status

In general precision agriculture has gained a lot in importance and use in the last few years also in Slovenia, mainly because of the savings and many other advantages. It is used in large to medium-sized agricultural companies for the optimal use of fertilizers and plant protection products. As they can save up to 20% of the resources and reduce our adverse environmental impact, more and more farmers are embracing PA technologies. For example, drone supported inspections and the use of precise GNSS systems for optimal navigation of agricultural machinery are just one of these and some companies are investigating possibilities of incorporating precision engineering (sensors, electronics, automation, electrostatics) into their agricultural implements and machines to further improve the food production processes. Of course, there are regional (demographic and geographic) characteristics that shape the use of PA and are investigated in the following paragraphs.

The statistical data (2016) shows that the average Slovenian farmer is old, with 57 years of age. Only 4.6 % of farmers are younger than 35 years and 28.5 % are older than 65. A lot of the farmers do not have a successor and young people are moving from the countryside to the cities which makes the problem of aging farmers even harder. But those young farmers that remain are well educated, with an increase of 18 % more formally educated farmers from 2013 to 2016 alone. The education plays an important factor when embracing new technologies such as in the area of PA.

The other obstacle that farmers face is the geographical characteristic of the region. 75.7% of all arable land in Slovenia have limited possibilities for farming, where 56 % if this are mountain areas, 16 % special areas and 3,5 % other areas. Farming in mountain areas presents a bigger challenge where special, more expensive equipment is needed. According to the data from 2016 there were 69 902 farms, out of which 231 were companies and 69 671 family farms that managed and average farm of 6.9 ha in size and 898 365 ha in total for the whole country. 57% are of this are grasslands and pastures, 36.8% fields and 5.6 % permanent plantation.

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<sup>1</sup> provided from University of Maribor: Peter Berk, Damijan Kelc, Miran Lakota, Jurij Rakun, Denis Stajnko, Peter Vindiš and AG-ROBO.net: Peter Lepej, Peter Polič.

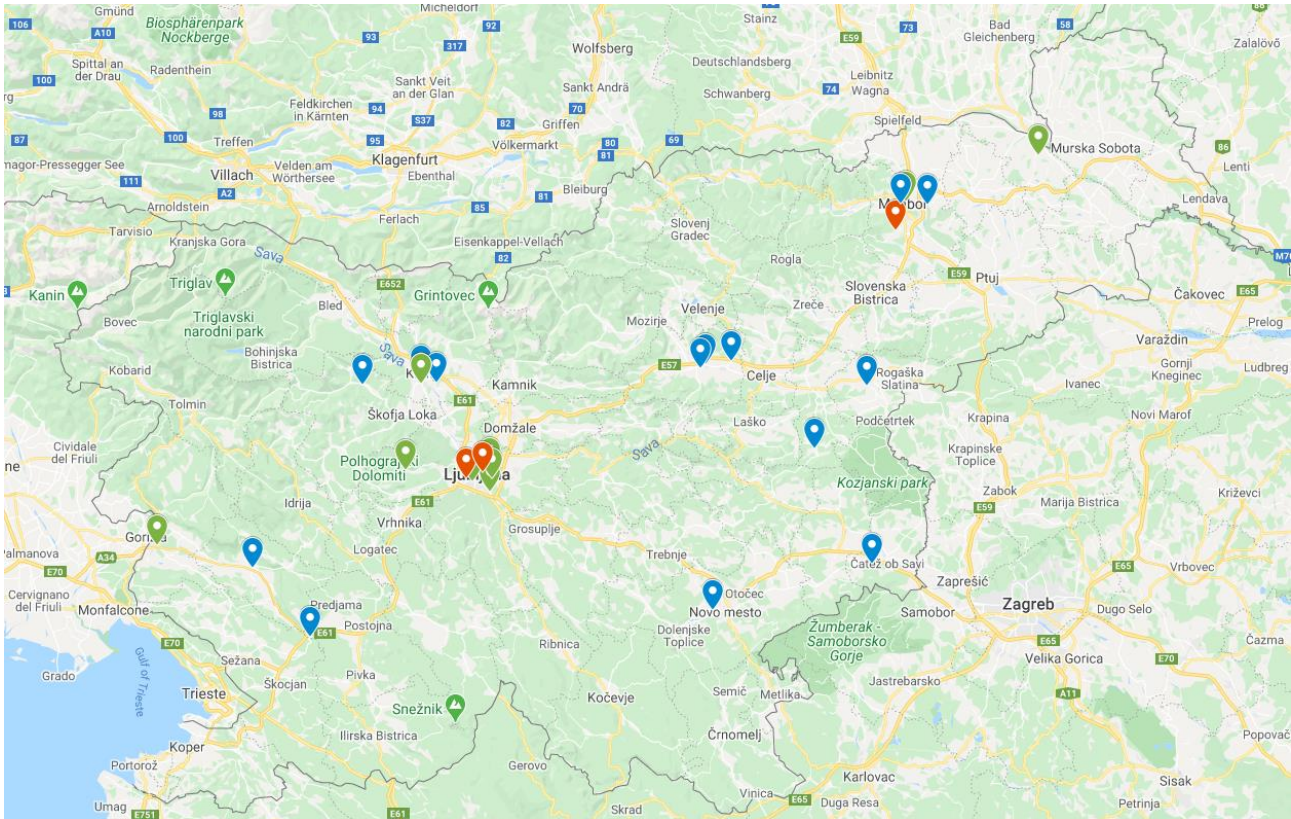
In retrospective to this the overview of the OEMs related to PA has identified the following regional characteristics; rigidity of big manufactures to the solutions in the area of PF, integration of non-domestic products to the OEM's solutions, agility of new smaller (start-up) companies and the tendency to service driven business plan.

Some of bigger OEMs in Slovenia were removed from the list of manufacturers after product portfolio was investigated in greater depth. Some of those that remain develop their own precision farming solutions and some integrate (non-domestic) third party solutions into their product, making their products smarter and precision farming enabled.

On the other end of the spectrum, we have small (usually start-up) companies with new ICT related solutions to help the farmers to save on input resources and to help manage the farms. In most cases they incorporate cloud driven service which is offered to the farmer and capitalised in form of a monthly at a fee.

Both of this aspect are understandable when taking into account the demographic characteristics of the area that were already explained. The big producers still rely on the development of the equipment for the aging population that buys simple equipment that is cheaper than the precision farming enabled one. The farms in Slovenia are small which prolongs the return on investment factor. So the precision farming enabled solutions are in general sold abroad. The presence of smaller companies on the other end can be explained by the interest of younger farmers that have the formal education, which are the farmers that are taking over the farms and grew up with ICT. This farmers embrace solutions (services) offered by smaller companies that are making their way in to the market because they help to make a saving on the resources and they help them manage their farms.

The following figure depicts the location of identified OEMs (blue flags), service providers (green flags) and research institutions (red flags) in Slovenia.



**Figure 1:** Depicts PF related businesses (15 blue flags), PF related service providers (9 green flags) and reserch institutions (3 red flags).

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

### 1.2.1. Steering Systems

The following business entitles have been identified in Slovenia in the area of steering systems:

**AGROMEHANIKA D.D.**, Hrastje 52a, 4000 Kranj (<https://agromehanika.si/>) - Agromehanika is the leading producer of agricultural machinery in Central and South-Eastern Europe. For over 50 years, Agromehanika has been synonymous with quality, reliability and development - features recognized by many farmers and business partners. It produces AGS sprayers, AGP mist blowers and compact AGT tractors.

Agromehanika incorporates into their systems equipment from other manufacturers such as GPS navigation G7 Farmnavigator from AvMap, which is an innovative agricultural navigator, designed to precisely farm agricultural land. It enables satellite guidance over the field and more precise crop processing. It is used for sowing, spraying and fertilization.

### 1.2.2. Tillage/Soil Cultivation and Seeding Equipment

The following business entities have been identified in Slovenia in the area of tillage / soil cultivation and seeding equipment:

**INO BREŽICE d.o.o.**, Krška vas 34b, 8262 Krška vas (<https://www.inobrezice.com>) - Produces solutions such as flail mowers, fertiliser spreaders, seed drills, vibrational subsoilers and smart solutions such as smart align (patented safety device for aligning the PTO shafts flail mowers), smart assist (that controls the speed of the tractor, PTO RPM, linkage position and other), smart flow (spreader control), smart hopper (indication system for hopper machines that inform the operator when the loading box is full), vibration control (IoT device used to control of the level of vibrations on INO flail mowers and on other devices) and secure tronic (folding protective system for flail mower).

**SIP Strojna Industrija d.d.** Juhartova ulica 2, 3311 Šempeter v Savinjski dolini (<http://www.sip.si/company>) - SIP is the biggest producer of agricultural machinery in Slovenia. The core product range consists of: mowers, tedders and rakes. They incorporate the use of sensors and end switches to make smart turrets and rakes.

### 1.2.3. Forestry equipment

**PIŠEK-VITLI KRPAN** Jazbina 9 a, 3240 Šmarje pri Jelšah, Slovenia (<http://www.vitli-krpan.com/en/contact>) - Vitli KRPAN is the producer of agricultural and forestry machinery. It is the company with the longest tradition in production of forestry winches in Slovenia which started in 1977. Several decades of experience in this field clearly serve as the company's major competitive advantage, as well as a guarantee for quality, durability and the robustness of its products.

The forestry winch still remains the most important product of the company, for Vitli KRPAN presents itself as the world's leading winch manufacturer. These include smart sensors that prevent excessive inclination of the machinery.

**UNIFOREST D.O.O.** Latkova vas 81 d, 3312 Prebold, Slovenija (<https://uniforest.si>) - An environmentally friendly company with high-quality, innovative machines. They include on their products the so-called smart end switches that can turn off the machine in the event of improper operation of the machine and potentially dangerous tilts.

**ROBUST d.o.o.**, Arja vas 105, 3310 Petrovče, Slovenija (<https://www.robust.si/>) - Under the registered trademark ROBUST, they produce and market hydraulic log splitters with a nominal strength of 13 to 25 tons of their own design. Products are innovated, patented and modelled, manufactured according to EU standards and meet all safety and health requirements. Like the two predecessors they incorporate electronic devices that stop the machines if tilting is detected.

**TAJFUN d.o.o.**, Planina 41 a, SI-3225 Planina pri Sevnici (<http://www.tajfun.com/>) - focuses on the production of winches, firewood processors, mobile tower yarders, forestry trailers, tractor cranes, hydraulic cranes and forestry information systems. Besides the smart antitilt winches the TajGO is the closest solution related to precision agriculture. It uses digital camplers and mobile application for reading, recording, editing, and printing of acquired data from measuring the forest wood assortments (trees, logs and boards). It is designed for individual forest owners, owners of small sawmills and professional users - foresters and wood-handling professionals.

#### 1.2.4. Spraying equipment

**AGROMEHANIKA D.D.**, Hrastje 52a, 4000 Kranj (<https://agromehanika.si/>) - Agromehanika is the leading producer of agricultural machinery in Central and South-Eastern Europe. For over 50 years, Agromehanika has been synonymous with quality, reliability and development - features recognized by many farmers and business partners. It produces AGS sprayers, AGP mist blowers and compact AGT tractors.

Their novelty in the field of sprayers is the AG tronik M1. It is an advanced sprayer computer for sprayers designed for more demanding users. Its features are: smaller and more efficient use of the spray, better and more precise spraying, control of the sprayer from the tractor cabin, and therefore less exposure to chemicals.

**ZUPAN d.o.o.**, Celestrina 3, 2229 Malečnik (<http://www.zupan.si/>) - is the company for the production of high quality machinery and plant protection and care products with a focus on of custom-made machines and wishes for the demanding customers. They focus on different kinds of spraying equipment, cleaners and also movers.

In the area of precision farming they use ultrasonic equipment and electrostatics to control the deposition of the plant protection products on the plants. They integrate spraying computers from Inovel (Germany), ARAG (Italy) and Gotrack (Poland).

#### 1.2.5. Plant inspection and environmental control

**C-Astral d.o.o.**, Tovarniska cesta 26, SI-5270 Ajdovscina (<https://www.c-astral.com/>) - C-Astral is an aerospace solutions provider based in Ajdovscina, Slovenia, the “hub” of advanced aerospace development and integration in this part of Central Europe. The company is a global market leader with established reputation in the specialized, fixed wing small Unmanned Aircraft Systems (UAS) manufacturing and services field, with a specific focus on high productivity, endurance, surveying and remote sensing. C-Astral's customer base is diversified between the commercial UAS operators, larger institutional networks, scientific users as well as government entities. In the area of precision agriculture the aerial vessels are used in mapping services (orthophoto, thermography, point cloud, multispectral, laser).

**LOTRIČ Meroslovje d.o.o.**, Selca 163, SI - 4227 Selca (<https://www.exactum.com/>) - LOTRIČ Metrology is a family company with 83 employees that have been developing and offering metrology solutions for 25 years. They are developing state of the art, highly perfected, but easy to use metrology products and services. One such interesting solution that also covers the field of precision agriculture is exactum.

Exactum is smart automatic control system - is an innovative measurement systems solution that enhances the workflows in industry, healthcare, labs, warehouses, greenhouses, galleries, transportation, or wherever conditions are demanding. It is an investment in quality that makes your work easier and safe and comfortable. In the case of greenhouses, the system collects and analyses climate and soil data in order to optimize greenhouse cultivation and reduce the use of resources - water, fertilizers, electricity.

**TRAPVIEW HQ - EFOS d.o.o.**, Razdrto 47B, 6225 Hruševje (<https://www.trapview.com/>) - EFOS d.o.o. is a company that produces TRAPVIEW, which is an automated pest monitoring system that monitors all kinds of insects, which can be lured into insect traps. The system consists of three fully integrated, automated and easy to use tools. With significantly raising accuracy and decreasing costs of pest control TRAPVIEW provides an innovative solution for farmers, advisers and researchers.



### 1.2.6. Animal Monitoring

The producers of animal monitoring equipment in Slovenia:

**IRNAS - institute for development of advanced applied systems**, Valvasorjeva ulica 42, 2000 Maribor ([www.irnas.eu](http://www.irnas.eu)) - the company focuses to apply the vast scientific knowledge to everyday reality by creating effective and affordable systems. They offer end-to-end IoT solutions for specialized use-cases, ranging from LoraWAN IoT node development, drone mapping sensor network coverage and edge computing off-grid devices for advanced sensor and image processing in limited bandwidth scenarios. A few practical examples of these solutions are: Sea Turtle Tracking, Air Quality and Radiation and Penguin Monitoring.

**SENSEEDGE d.o.o.**, Podbreznik 15, 8000 Novo mesto (<http://sensedge.co>) - Sensedge has developed a sensor platform for agriculture of the future. AgriSense MicroUnits allows you to monitor many parameters in fields, greenhouses and plant canopies. The platform also allows monitoring of the movement of animals and the condition of grazing equipment. MicroUnits are based on LoRaWAN technology, where the data is sent to a cloud platform to analyse the measured parameters that can be monitored and performed. If the pre-set thresholds are exceeded the system triggers an alarm, notifying the farmer that it needs to react.

**TELOS d.o.o.**, Ljubljanska cesta 24G, 4000 Kranj (<http://www.telos.si/>) - Establish advanced smart management and control systems. The LoRa system enables tracking and monitoring of livestock by identifying diseased animals while detecting toxic gases in stables and cages.

### 1.2.7. Bale dryers

The following producers of bale dryers equipment in Slovenia has been identified:

**GROS d.o.o.**, Ljubljanska cesta 4, SI-4000 Kranj (<https://www.gros.si/>) - focuses on the production of hay blowers, drying systems, spreaders and other. Their interesting solutions in the area of precision farming include bale dryers and spreaders.

Automated bale dryer works according to the reading of the probe that is located inside the bale and the other on the external site to measure the air, which makes possible to precisely control the fans. This saves electricity and time.

Automatic hay spreaders are computer guided which makes it extremely adaptable to the shape of a senile. The telescopic spreader spills up, down, left, right but only when hay is present in the hose. The built-in photocell allows extremely uniform spread of hay across the available surface. Hay does not accumulate, which allows faster and more efficient drying.

### 1.3. High-performing service providers, by service

**SLEDAT, Uscom d.o.o.**, Polhov Gradec 93, 1355 Polhov Gradec (<http://sledat.si>) - Sledat Agriculture is an information solution for agricultural holdings that works in the cloud and it is designed to support and manage all key data on jobs on farms both in the office and on the ground. The information solution consists of a web application designed for entering and managing various records and a mobile application designed to capture data directly on the ground.

Sledat Agriculture is a solution composed of several modules that form a single and efficient system tailored to the needs and requirements of your farm. Access to data directly in a stable, on a field or in an orchard. This was followed by a follow-up mobile application that allows you to use your smartphone or tablet anywhere, at any time, to enter data or access the data you have entered where you need it. The information entered is automatically saved directly to the server and displayed in the web application. The web application enables the preparation of data for various reports, as well as for strategic decision-making.

**Elmitel software development**, Orehovci 1a, 9250 Gornja Radgona ([development.elmitel.com](http://development.elmitel.com)) - focuses on the development of smart cloud services to support vine and orchard growers with two dedicated web platforms eVindeyards and eOrchards. In addition, it also offers EIGIS GIS software and IoT Sensing platforms aimed to support precision farming applications.

**GEOSERVIS d.o.o.**, Litijska cesta 45, 1000 Ljubljana (<http://www.geoservis.si/>) - Company Geoservis, d.o.o. is an authorized seller of measurement equipment for geodesy, GIS, construction and mechanical engineering and navigation equipment. They are representatives by the world-renowned brands Leica Geosystems and geo-Fennel.

The activity comprises certified service, technical support and consulting, management of the permanent GNSS network, and implementation of projects with specific requirements, such as planning, setting up and operating systems for observing movements and deformations, consulting, installation and implementation of machine management solutions.

The reference station GNSS Geoservis is the first ever operating reference station in Slovenia. It was installed in 1999, and in 2000 it was included in the European network of reference stations of the EPN (Euref Permanent Network).

**TERMODRON d.o.o.**, Ulica škofa Maksmilijana Držečnika 6. 2000 Maribor (<http://www.termodron.si/>) - They offer drone inspections to help the farm optimize its use of fertilizers and plant protection products. They ensure that their service can save up to 20 % of these resources and reduce the environmental impact. After the flight, the data is processed and compiled by Vegetation Indexes (NDVI). After consultation, they prepare target models for importation on mechanization, where variable fertilization is possible with electronically controlled mechanization, with or without GPS support.

**SINERGISE d.o.o.**, Cvetkova ulica 29. 1000 Ljubljana (<https://www.sinergise.com>) - The company has developed and advanced GIS information system that is an integral part of the IACS (Integrated Administration and Control System) policy. The main part of the system known as GERK is used as a tool for the entire agricultural policy and outside the institution. The company also participates in international projects and their clients are important institutions. They have developed: agricultural Register (web application), GERK (Java based tools), Giselle Farm Management (Information System, Farm Management), Controls (support for inspectors during fieldwork), Visual control (LPIS change control application), Disease control (control of infectious diseases in animals), Land consolidation (application, computer support for the management and process of agricultural land consolidation), Reclamation (management of reclamation infrastructure and agricultural land where reclamation is carried out), Register of Wine Producers. (<https://www.sinergise.com/sites/default/files/attachments/leaflet-agriculture.pdf>)

**TELOS d.o.o.**, Ljubljanska cesta 24G, 4000 Kranj (<http://www.telos.si/>) - Establish advanced smart management and control systems. The LoRa system, with the help of an IoT solution, is intended for agriculture, with the help of which we can optimize watering, fertilization and spraying, thereby significantly improving the hectare yield.

**GDi Business Technology Solutions d.o.o.**, Šmartinska cesta 106. 1000 Ljubljana (<https://gdi.net>) - They provide smart tools and applications for efficient food production. They use GPS systems, satellite data and drone technology to collect data to provide location-based information. Their ensemble for Smart Agriculture provides: different types of agricultural data, past and current information on crops, yield and fertilization, more optimal decisions for planting, fertilizing and harvesting.

**DATALAB Agro SI d.o.o.**, Hajdrihova 28c, 1000 Ljubljana (<https://www.datalab.si/>) - Datalab combines different types of agricultural activities (agriculture, fruit growing, livestock production, viticulture, etc.) into one system. Pantheon Farming includes applications, various integrations of the Internet of Things, data sharing and an office background. The system is tailor-made for each agricultural activity. For example, in animal husbandry we can enter records for individual animals, family trees of animals, animal registry, milking and veterinary diary, feeding, housekeeping. They can also keep an overview of costs, goods, bookkeeping and FADN reports.

**SAOP d.o.o.**, Cesta Goriške fronte 46, 5290 Šempeter pri Gorici (<http://www.saop.si/>) - Their miniMAX online accounting program for farm households simplifies administration. Farms can, through the miniMAX program, keep a book of received invoices, invoices, manage current operations, manage payment transactions and report DURS.

The latest innovation in miniMAX is a farm chart of accounts that makes it easier and more transparent to monitor your business. The chart of accounts replaced the manual management of FADN records and accelerated many bureaucratic tasks.

#### 1.4. High-performing research bodies, by typology

There are three institutions related to the area of precision agriculture in Slovenia. The first two are the agriculture faculties - Faculty of Agriculture and Life Sciences (University of Maribor; [fkbv.um.si](http://fkbv.um.si)) and Biotechnical faculty (University of Ljubljana; [bf.uni-lj.si](http://bf.uni-lj.si)) - and the third is the Agricultural Institute of Slovenia (KIS; [www.kis.si](http://www.kis.si)).

##### **Biotechnical Faculty, University of Ljubljana**

The fundamental mission of the Biotechnical Faculty (Biotehniška fakulteta) is to provide university level, advanced professional, and postgraduate education, as well as to carry out scientific research and technical and consulting work concerning the sciences of living nature (biology, microbiology) as well as agriculture, forestry and fisheries (forestry, animal husbandry, agronomy) and the related production technologies (wood technology, food technology, biotechnology).

Focal points: graduate and post graduate education, scientific research and technical work.

Sciences: living nature (biology, microbiology), agriculture, forestry and fisheries (forestry, animal husbandry, agronomy), production technologies (wood technology, food technology, biotechnology).

Departments:

- Department of agronomy
- Department of biology
- Department of forestry
- Department of landscape architecture
- Department of wood technology
- Department of animal science
- Department of food science
- Biotechnology studies
- Microbiology studies
- Chair of sports education

The Biotechnical Faculty employs 700 members. At the Biotechnical Faculty in 2018, research work was carried out in the 156 research projects. There were 27 national (basic, applied and postdoctoral) projects, 17 were CRP projects and 112 were international.

### **Faculty of Agriculture and Life Sciences, University of Maribor**

The Faculty of Agriculture and Life Sciences (Fakulteta za kmetijstvo in biosistemske vede) is one of the 17 faculties of the University of Maribor. It is a scientific and educational institution and is, due to its integrational work and effectiveness, in league with successful universities around the world. As a university member, the faculty represents the progress of science in many fields of agriculture resulting in a good bibliography (high-impact original scientific papers, conference contributions and patents).

The faculty is located in the centre of the most important agricultural region in Slovenia, facilitates a good combination of theory and practice and enables the application of academic knowledge to practical work. Part of the research and educational activities of the Faculty of Agriculture and Life Sciences are carried out at the university's agricultural centre. It is located at the foot of Pohorje, about 12 km from Maribor and covers:

- 55 ha of fruit tree plantation,
- 60 ha of fields,

- 18 ha of vineyards at Meranovo,
- 22 ha of grasslands,
- 240 ha of forests,
- 8 ha of botanical garden area.

These are used for research and for the practical work of about 700 students and 70 members of teaching staff.

The Faculty of Agriculture and Life Sciences has numerous accredited undergraduate and postgraduate study programmes. We offer 8 undergraduate study programmes: Agriculture and Environment, Agronomy-Ornamentals, Vegetables and Field Crops, Biosystems Engineering, Organic Farming, Agricultural Economics and Rural Development, Viticulture, Enology and Fruitgrowing and Animal Science. The first one is more academically oriented while all others are professionally oriented. Currently, there are 3 Postgraduate study programmes (Master's programmes): Agricultural Economics, Agriculture and Food Safety and 2 Postgraduate study programmes (PhD): Agricultural Economics and Agriculture.

Educational and scientific research units at the Faculty of Agriculture and Life Sciences:

Animals sciences, Agricultural economics, Biosystems engineering, Botany and plant physiology, Chemistry, agrochemistry, Genetics, Grassland management and forage production, Field crops, Fruit production and fruit processing, Mathematical methods, informatics and statistics in agriculture, Microbiology, molecular biology, biochemistry and biotechnology, Organic farming, Ornamental plants, Phytomedicine, Plant improvement, Rural development, Soil science, Vegetables and Viticulture and enology.

In 2018 FALS employed 61 employees and was involved in the last evaluation period (2014-2018) the research work was on conducted on 127 research projects. There were 104 national (CRP, basic, applied and postdoctoral) projects, out of which 14 were in 2018, and 23 were international, out of which 4 were conducted in 2018.

### **Agricultural Institute of Slovenia (KIS)**

Agricultural Institute of Slovenia (Kmetijski inštitut Slovenije) is the leading agricultural research institution in Slovenia. It comprehensively deals with the problems of modern agriculture and expands its activities in the field of environmental protection and ecology. It employs 195 workers, including 89 researchers.

The Agricultural Institute of Slovenia is a public research institute that performs basic, applied and developmental research and professional tasks in agriculture, publishes the results of scientific-research, professional and control work, performs tasks on the basis of authorizations and accreditations, checks the quality of agricultural products and products used in agriculture. The Institute is also involved in training farmers, educating young people and advising various users in agriculture. Areas of activity:

- agriculture and horticulture with seed production,
- genetics, breeding, maintenance selection and gene banks in agriculture,
- animal husbandry (cattle, pig, beekeeping),
- fruit growing, viticulture and winemaking,
- protection of plants and the environment,
- fertility control and quality of agricultural land,
- ecology of agricultural area,
- land use and protection,
- analysis of soil, mineral and organic fertilizers, animal feed, honey, pesticide residues, plant protection products, wine,
- must and spirits,
- agricultural technology and energy; and economics of agriculture.

In 2018 KIS employed 191 employees and was involved in research work was on 54 research projects. There were 24 national (CRP, basic, applied and postdoctoral) projects and 28 were international.

## 1.5. Overview of existing networks

**ITC, Innovation Technology Cluster, Lendavska ulica 5a, 9000 Murska Sobota (<https://itc-cluster.com/sl/>)** - Digital Innovation Hub for Agriculture and Food Production (DIH AGRIFOOD). They combine Slovenian and European research and development expertise on digitalisation in agriculture (smart agriculture). Their goal is to provide a 'One Stop Shop' that will provide organizations with services in the region to provide safe, sustainable and quality food.

**AE-ROBO-NET, Liminjanska 96, 6320 Portorož-Portorose (<http://www.ae-robo.net>)** - AE-ROBO-NET cluster was funded to provide agricultural and environmental robotics systems and

services appropriate to the needs of farmers, road operators, eco remediation providers and underwater construction operators thereby increasing their efficiency, innovative potential and ecologically friendly operations.

The network organization provides an ever-expanding knowledge base, which is based on user-friendly research and development activity, which stimulates innovation. The network association contributes to the development of competitive agricultural and environmental robotic systems needed by domestic and international agricultural and environmental providers, thereby increasing the efficiency of both sectors, and profit-making ability.

**Slovenian Agricultural Engineering Society, Hacquetova 17, 1000 Ljubljana ([www.dkts.si](http://www.dkts.si))**

- The basic task of the Association is to encourage scientific and professional work in the field of production, use and sale of agricultural technology, its rational and safe use, automation and precision agriculture, organizing various forms of information, training and education of members (congresses, symposia, consultations, workshops, professional courses, lectures, consultations, discussions, excursions, competitions, etc.).

Much attention is paid to informing members and the general public about the work of the Society, taking care of raising the technical culture and publishing professional books, publications and information.