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PRECISION FARMING POLICY & ECONOMIC REVIEW ANALYSIS

D.T1.1.2 PRECISION FARMING POLICY ECONOMIC REVIEW ANALYSIS

Slovenia

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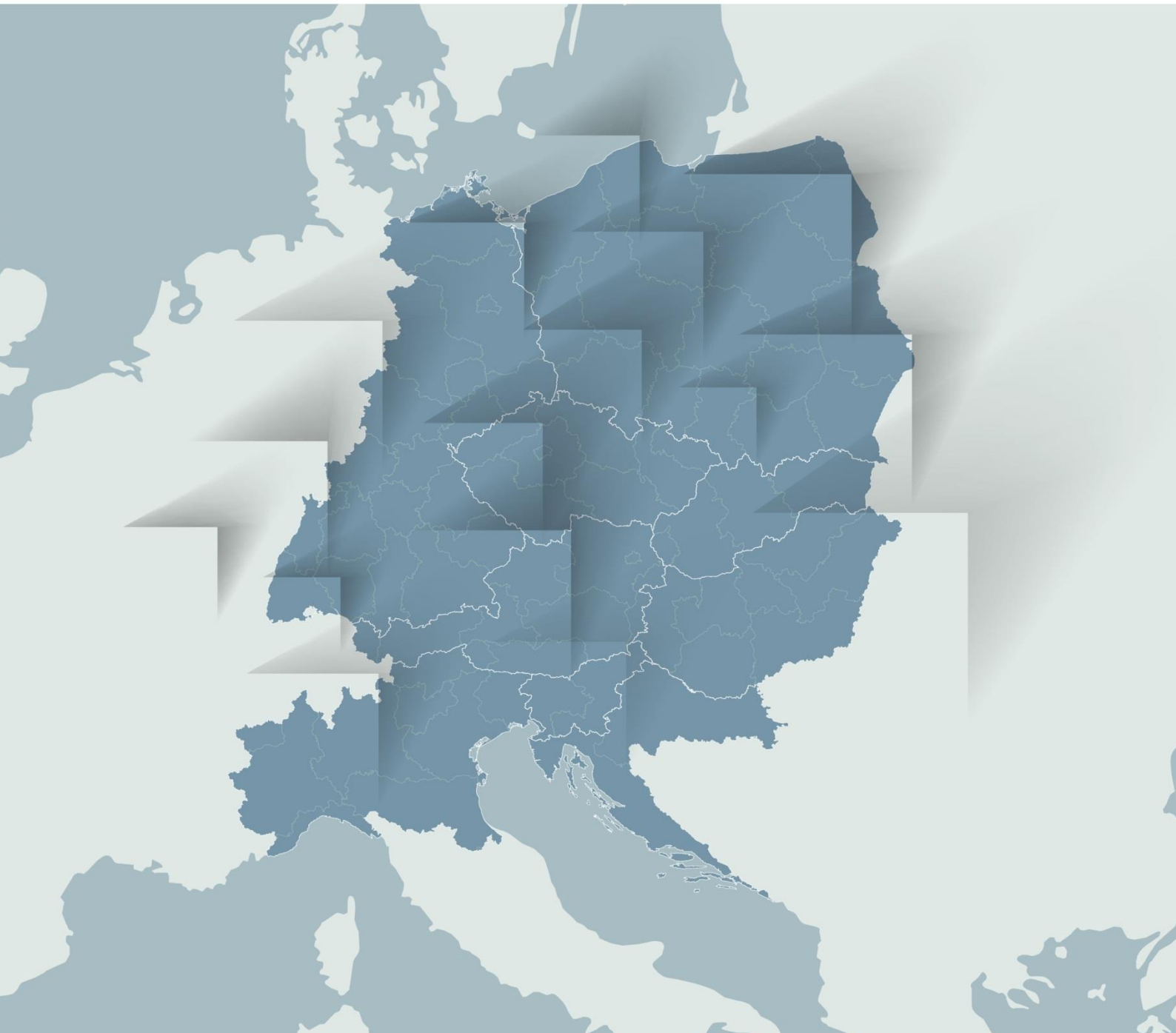

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1. Role of PF industrial sector - Overview about industry/companies

One of the most important factors for the mass implementation and practical exploitation of PF and technologies is the bridging of the gap between PAT producers and the other stakeholders. In recent years, the production of agricultural equipment with PF components in Europe has increased, but there is a lack of general information on producers and traders (suppliers) of PAT in the EU and Slovenia. There is almost no heavy industry of PAT in Slovenia. There are a few companies that supply PA components from other countries and then install them on their agricultural machinery products. Quite a few service companies operate successfully, offering various services in PA such as GPS, GIS, drones, sensor systems, yield mapping, etc. Manufacturers and service providers are listed in Table 1.

Table 1: The list and brief description of companies in Slovenia that produce, install or offer PAT services in their products.

Company name	Description of the solution
Agromehanika, d. d.	(GPS) G7 Farm navigator 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.
C-Astral, d. o. o.	The company operates in the field of production and services of small drones. In the field of PA, they provide remote sensing services in agriculture.
Datalab Agro SI, d. o. o.	Is developing an information system that helps manage business and technological processes in various modules or agricultural activities. Their system can be connected to various data sources, which enables optimization of production and precise strategic decision-making.

[1] provided from University of Maribor: Peter Berk, Damijan Kelc, Miran Lakota, Jurij Rakun, Erik Rihter, Denis Stajnko, Peter Vindiš and AG-ROBO.net: Peter Lepej, Peter Polič.

Efos, d. o. o.	The company develops information solutions in the field of environment and food. Their systems allow automatic recognition and monitoring of insects and water quality.
Elmitel, d. o. o.	In addition to web and mobile applications, they are developing IoT, GIS and data analysis technologies.
GDi poslovne tehnološke rešitve, d. o. o.	They offer smart tools and applications for optimized food production and production. They use GPS and remote sensing for data collection and localization.
Geoservis, d. o. o.	Company for measurement systems, software and solutions in the field of spatial data. The systems include GNSS receivers, GIS, drones and others.
Gros, podjetje za proizvodnjo in projektiranje, d. o. o.	Their computer-controlled hay spreaders include a control unit that allows surface adjustment, visibility of the opening position and adjustment to the shape of the hayloft. With the help of sensor systems on their dryers, it is possible to automate and optimize the drying of feed.
INO Brežice, d. o. o.	Uses advanced innovative electronics and sensor systems (vibration control on machines, seed material control) in fertilizer spreaders and seed drills.
Irnas, d. o. o.	They offer complete IoT solutions for specific applications: node development, network coverage with drone sensor systems.
Lotrič Meroslovje, d. o. o.	They have developed a solution for automatic control in the field of measuring systems. The innovative solution improves the control of parameters, thus making it possible to improve work processes in agriculture.

Saop, d. o. o.	Their online accounting program simplifies the management of bureaucracy on the farm. With their program it is possible to keep various records: transactions, accounts, FADN.
Sensedge, razvoj inovativnih rešitev, d. o. o.	They are developing a sensor platform for the agriculture of the future, which promises to monitor a number of parameters in different agricultural circumstances. The obtained data is sent to the cloud platform, where it is possible to monitor and perform analytics.
Sinergise, laboratorij za geografske informacijske storitve, d. o. o.	The company has developed an advanced GIS infrastructure, which is an integral part of IAKS policy (Integrated Administrative and Control System) or the main part of the GERK system (graphic unit of agricultural use).
SIP Strojna Industrija, d. d.	The largest company for agricultural machinery in Slovenia. With their long tradition, they produce quality and robust agricultural machines. Products include the use of sensor systems and limit switches. They have already participated in many projects like development of a new generation (G3) of disc mowers, RRI project AIRSWATH (AS).
Telos, d. o. o.	They set up advanced management and control systems. Their system enables optimized watering, fertilizing and spraying with the help of the IoT solution. They have also developed a system that allows tracking of animals.
Termodron, d. o. o.	They enable overflights, preparation and processing of vegetation indices (NDVI) with the help of drones. Their solutions promise 20% of savings in the consumption of fertilizers and plant protection products..

Uscom, d. o. o.	Their cloud agriculture information system consists of several modules. The module is designed for farm management and combines an effective system tailored to the needs of farm management.
Waboost, d. o. o.	In the field of agriculture (irrigation), they are professionally engaged in disinfection and stabilization of drinking water for animals. Their business activity is also sustainable wastewater treatment.
Zupan, d. o. o.	They make various injection molding devices. include electrostatic spraying, which offers a number of advantages, such as better application, higher droplet application, time savings and up to 30% less resources used and lower environmental impact

2. Impact of PF – Status in the region

Precision technologies support farmers in providing safe, sustainable and quality food. Not only does it help farmers to produce 'more with less', but it also contributes to combating climate change. Existing and new technologies contribute to efficient processes and lead to the creation of new products and services in the region. Precise technologies are also important in creating a better life in the region's countryside.

The impact of precision farming on the region is increasing and more and more farms are optimizing their production with the use of precision technology. There are savings in many areas: processing time, consumption of fertilizers and plant protection products, quality of work performed, quality of products, and many more. Effects on the environmental pollution are reduced; less fuel, seeds, pesticides. Slovenian companies are already including precision engineering, such as sensors, smart electronics, weighing and other, in agricultural machinery. Due to the mentioned facts, the quality of life in the region has also improved in terms of less air pollution, less pollution of water sources with nitrates, pesticides, etc.

Another positive potential of PF in the region lies in new PF products and prototypes of well-known brands. Producers and users see more additional time for other working activities. Administration is reduced as the data is automatically stored in the data cloud when the work is done. The future of PF is bright as the interest in PF products and services is growing in this region.

With the increase of PF in the region, new markets are opening, new sales channels, new service services for development, use and service of precision technologies, use of satellite data, selective fertilization and spraying technologies and support for farmer data management are opened. Further PF role is developing into other less developed agricultural industries like forestry, fruit-growing, viticulture, vegetable growing, new opportunities for different areas of application of PF applications on agricultural holdings. With education and advice to users for various areas of PF increases awareness of technology to achieve better production results and better crop quality. A change in the government's policy in the field of development and promotion of PF would make the impact of new technologies on the region even better, so it is necessary to accelerate the development of precision technology with appropriate activities. The state has an extremely important role in this, as the initial investment in the use of PF is too high according to the size of agricultural holdings in the Slovenian region.

Precision agriculture, however, not only gives positive effects on the part of food producers, but directly brings positive effects for the development of new companies and jobs engaged in the development, promotion and servicing of these technologies.

According to the survey results, 57.5% of the respondents are aware of the potential of PF technologies and will use them in the future, some are introducing PF (12.5%) and some are already using them (7.5%). Also 97.5% of the respondents are already educated in PF. They

also see great potential in the development of technology for precision fertilization and the use of pesticides. According to this data PF has a very big potential to develop in the region because of the positive economic and environmental effect.

3. Support PF at Policy level in Slovenia

Slovenian agricultural policy promotes sustainable development, cost-effectiveness and competitiveness of agriculture in Slovenia, fostering socially responsible and environmentally friendly practices. The focus is on providing food security by ensuring the stable production of safe and easily accessible high-quality food, while maintaining a clean environment and fertile soil and promoting coherent development and settlement of rural areas. Additionally, support is given for promoting technological innovation and applying new insights to modernise agricultural practice. Another area of focus is the sustainable development of forests, which are essential to the Slovenian natural and cultural heritage and landscape.

Rural Development Program (RDP 2014-2020)

Rural Development is the second Pillar of the Common Agricultural Policy, providing Member States with an envelope of EU funding to manage nationally or regionally under multi-annual, co funded programmes. The National Rural Development Program for the period 2014–2020 is a joint programming document of the Republic of Slovenia and the European Commission. The document represents the program basis for drawing financial resources from the European Agricultural Fund for Rural Development (EAFRD).

In addressing challenges in agriculture, the RDP for Slovenia funds action under five out of six rural development priorities - with a particular emphasis on restoring, preserving and enhancing ecosystems related to agriculture and forestry, competitiveness of agri-sector and sustainable forestry, and business creation and local development in rural areas.

Operations for the development of PF in Slovenia can be indirectly included in the set of three areas:

1. accelerating the processes of structural adjustment in agriculture and thus creating conditions for increasing the productivity of Slovenian agriculture,
2. promoting agricultural practices that have a positive impact on the conservation of natural resources and adapting to climate change,

3. transfer of knowledge and innovation and care for the environment and climate change.

European Innovation Partnership (EIP)

EIP-AGRI in Slovenia operates within the measure RDP (2014–2020) M16 - Cooperation and sub-measures M16.2 - Development of new products, practices, processes and technologies - and M16.5 - Environment and climate change.
The aim is to establish new and innovative solutions by disseminating practical results for methis through an interactive innovation model that brings together specific actors (farmers, researchers, consultants, companies, NGOs and others) with a clear, practical and innovative aspect. Actors set up operational groups with contracts and projects in which they plan to look for concrete innovative solutions to the real problem that the farmer perceives as the center of the groups on his farm.

Horizon 2020

Horizon 2020 is one of the most important financial instrument implementing the Innovation Union. The program will be active in the period 2014-2020. Seen as a means to drive economic growth and create jobs, Horizon 2020 has the political backing of Europe's leaders and the Members of the European Parliament. They agreed that research is an investment in our future and so put it at the heart of the EU's blueprint for smart, sustainable and inclusive growth and jobs. By coupling research and innovation, Horizon 2020 is helping to achieve this with its emphasis on excellent science, industrial leadership and tackling societal challenges. The goal is to ensure Europe produces world-class science, removes barriers to innovation and makes it easier for the public and private sectors to work together in delivering innovation. Horizon 2020 is open to everyone, with a simple structure that reduces red tape and time so participants can focus on what is really important. This approach makes sure new projects get off the ground quickly – and achieve results faster. The EU Framework Programme for Research and Innovation will be complemented by further measures to complete and further develop the European Research Area. These measures will aim at breaking down barriers to create a genuine single market for knowledge, research and innovation (source: https://www.gov.si/zbirke/projekti-in-programi/obzorje-2020/).

Social Challenge 2 (SC2) includes "food security, sustainable agriculture and forestry, marine and maritime research, and inland water research and the bioeconomy", which, among other things, opens up new opportunities for mass adoption of PF in the EU. The European Commission and Horizon 2020 are working to promote PAT and provide investment funding. The data (The Community Research and Development Information Service CORDIS, 2018)

show that 17 projects were presented in the EU by 2018, where PAT is at the center, and in addition, more projects were added to this in 2018. Encouragement is also mentioned in the period 2021-2027.

For Slovenia, active cooperation is a great opportunity due to access to funding, obtaining grants, international networking, research activities, access to new knowledge and learning from the case of best practices from abroad in terms of PF. For example, one of the projects within Horizon 2020 in Slovenia is PerceptiveSentinel: A platform for acquiring and re-creating BIG DATA knowledge, where the project coordinator is a company Sinergise laboratorij za geografske informacijske sistemi, d. o. o.

Partnership of the Factories of the Future

The Strategic Research and Innovation Partnership – Networks for the transition into circular economy (SRIP – Circular economy) is a connection of Slovenian business subjects, educational and research institutions (RRI), non-governmental organisations and other interested parties, in collaboration with the state.

Nine SRIPs have been formed, one of which is Partnership of the Factories of the Future. The objective of the Strategic Research and Innovation Partnership of the Factories of the Future is to create an open and friendly environment for the development of innovations that will be breakthrough and prospective and will go beyond the national framework. By linking partners from science and the industry and by engaging all common potentials, unprecedented opportunities for the development of new products and technologies are opening up, which will be an excellent basis for greater economic competitiveness in the international arena.

Partnership of the Factories of the Future consist of eight vertical value chains or focus areas: robotic systems and components, intelligent systems guides for the factories of the future, smart mechatronic tools, intelligent laser systems for factories and clinics future, smart plasma systems, advanced sensors, new materials and smart factories, and six horizontal networks: robotics, control technologies, nanotechnologies, photonics, plasma technologies, modern production technologies for materials.

These strategies provide an opportunity to develop technologies (digitalization, automatization, innovation) in the field of PF. Focus areas enable the interaction between available knowledge, competencies, capacities and industry needs.

Resolution "Our food, countryside and natural resources after 2021"

The purpose of this document is to define the basic strategic framework for agriculture, food and rural areas for the period after 2021. The resolution is the basis for the preparation of a single Strategic Plan for the implementation of national CAP measures and mentions PF in the future. They note that the agriculture and agri-food of the future will follow the development of digitalisation and modern technologies. PA will ensure the achievement of stable production, targeted inputs, lower environmental burden and greater economic efficiency. Investment support measures will need to focus on reducing the technology gap as well as the impact of climate change. At the same time, the education and training of farmers will be more proactive.

4. Subsidies schemes supporting PF in Slovenia

Schemes supporting PF in Rural Development Program 2014-2020:

Action 1: Transfer of knowledge and information activities

Sub-action 1.2: Practical training for farmers based on the use of mechanization, processes, technologies, machines and practices. In this context, we could demonstrate to the farmers the importance and practical use of precision farming.

Action 4: Investments in agricultural holdings

Sub-action 1.2: Support for investments in agricultural holdings. This action includes the purchase of agricultural machinery, hardware and transport equipment. Here belongs all agricultural machinery, if it is proven to be economically usable (economic use is achieved with precise agriculture).

Sub-action 4.2.: Support for investment in processing / marketing and / or development of agricultural products. This includes the purchase of equipment and devices, including the purchase of laboratory and ICT equipment.

In particular, there are currently no tenders under the Rural Development Program that would support explicit investments in precision agriculture. Probably, these matters will be more supported in the next programming period.

5. EIP-AGRI Projects in Slovenia

5.1. EIP AGRI operational groups in Slovenia

Title	The implementation of new mechanical and autonomous automated technologies for the sustainable production of grapes in vineyards
Geographical location Main and other geographical locations	Slovenia Podravska Pomurska Savinjska
Keywords	Pest Disease control Cultivation (crop production) Non-chemical weed control Vineyard Grape
Starting – End date	2019 - 2022
Main funding source	Rural development 2014-2020 for Operational Groups (in the sense of Art 56 of Reg.1305/2013)
Description	With the help of new practices, processes and technologies we will ensure the sustainable production of grapes for wine in vineyards: demonstration of various non-chemical methods of controlling weeds in the belt under vines (without the use of herbicides), use of hightech modern spray techniques equipped with LIDAR sensors to the

	effectiveness of controlling diseases and pests of vines, conservation of biodiversity in the vineyard and its surroundings (enabling biodiversity in vineyards and reducing soil erosion) and beginning of the practice of measuring grape ripening in a vineyard (allowing the production of typical grapes for the production of top quality wine).
Contact person	Contact person: Univerza v Mariboru Address: Slomškov trg 15, 2000 Maribor E-mail: peter.berk@um.si Phone: 051 369 548 Partner category: Researcher

Title	Increasing productivity of agricultural production by increasing water use efficiency and sustainability (PRO-PRODUCTION)
Geographical location Main and other geographical locations	Slovenia Spodnjeposavska Pomurska Jugovzhodna Slovenija

Keywords	Agricultural production system Water management Climate and climate change Farming / forestry competitiveness and diversification Decision support system (DSS) Precision irrigation
Starting – End date	2019 - 2022
Main funding source	Rural development 2014-2020 for Operational Groups (in the sense of Art 56 of Reg.1305/2013)
Description	Low agricultural productivity in Slovenia is related to low water use productivity. Irrigation practice neglecting soil water retention capacity, plant water requirements and expected weathering reduces the quantity and the market value of agricultural produces. Suboptimal irrigation increases nutrient leaching and water use. Project EIP PRO-PRIDELAVA will increase water use productivity at farm level with irrigation decision support system by integrating plant water requirements, soil water retention capacity, real time soil water content, and evapotranspiration and precipitation forecast. Real time soil water content monitoring (TDR probes) at the farm level will be established. A system for monitoring and reporting plant development phases at farm level will be implemented. Irrigation requirements (mm of water per day) will be proposed at farm level based on a five day weather forecast model. Experiences with new irrigation scheduling will be disseminated to other interested farmers indirectly through workshops at demonstration farms, public lectures and conferences, with help of multi-media tools
Contact person	Contact person:

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Title	DI-Gozd (Digital Forest Inventory)
Geographical location Main and other geographical locations	Slovenia Jugozahodna Slovenija Podravska Osrednjeslovenska
Keywords	Pest / disease control Forestry Biodiversity and nature management Supply chain, marketing and consumption Farming / forestry competitiveness and diversification
Starting – End date	2020 - 2023
Main funding source	Rural development 2014-2020 for Operational Groups (in the sense of Art 56 of Reg.1305/2013)

Description	Digitally transform selected forest management processes, through the development of new innovative digital tools, databases, technologies and connections that will: - digitize and accelerate selected monitoring, planning and organizational processes of forest management activities - validated by end-users will strengthen the ecosystem in the forest-timber value chain of Kočevje - through the organization of events, the training of various stakeholders in the forest-timber chain, preparing publications, transferring knowledge to practice and disseminating project results, facilitate better forest management and ensure the sustainability of forest yield and all its functions.
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Title	Digitalizing vegetable irrigation
Geographical location Main and other geographical locations	Slovenia

	Osrednjeslovenska
Keywords	Digitisation Irrigation management Data-driven agriculture Vegetable
Starting – End date	2019 - 2022
Main funding source	Rural development 2014-2020 for Operational Groups (in the sense of Art 56 of Reg.1305/2013)
Description	By irrigation, we can mitigate the effects of drought in agriculture. But where irrigation is introduced, agriculture is the main consumer of water. Excessive irrigation causes the nutrients to flow through the floor profile, excessive water use for irrigation, poorer quality of crops and poor plant health. For quality irrigation, information is needed and, through the digitization of cultivation, the agricultural holding can access it easily and in a timely manner. In the project, we will develop a system that, based on a number of input data, calculates the amount of water needed for irrigation. Users will access information through an application, and information can be shared with other partners.
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Title	Electronic management of agricultural holdings with

	emphasis on forestry activity
Geographical location Main and other geographical locations	Slovenia Osrednjeslovenska Podravska Koroška
Keywords	Farming equipment and machinery Soil management / functionality Forestry Biodiversity and nature management Supply chain, marketing and consumption Farming / forestry competitiveness and diversification
Starting – End date	2019 - 2022
Main funding source	Rural development 2014-2020 for Operational Groups (in the sense of Art 56 of Reg.1305/2013)
Description	We believe that through the use of innovative technologies and a better understanding of the players in the forest value chain, we can develop a practical e-commerce system for everyday use. We have a great starting point because of our unique experience with establishing a functional online forestry information system (MojGozdar), of which we are the caretaker. We will strive to: -Relieve the bureaucracy of agricultural holdings by means of digitalisation of common business procedures and processes, -Connect supply and demand and optimize forest value supply chain,

	-Increase the transparency of forestry services market, -Intensify the management of private forests.
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Source: https://ec.europa.eu/eip/agriculture/en/eip-agri-projects