

# REGIONAL ACTION PLAN TO TRANSFORM THE REGIONAL INDUSTRIAL SPECIALIZATION IN PF IN S3 DRIVING FORCE

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D.T3.1.5  
MATE PP6 - Hungary

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## Introduction - the national guidelines on Precision Agriculture

Hungarian Government launched the **Digital Success Program** in 2015 to provide benefit for citizen and business from digitalization. Several programs were initiated within the DSP for example: Digital Education Strategy of Hungary, Digital Export Development Strategy of Hungary, Digital Startup Strategy of Hungary, Digital Child Protection Strategy of Hungary. Among these actions **DAS - Digital Agriculture Strategy of Hungary** is the most relevant to the Transform4.0 project.

**DAS** developed in 2016 by the members of the ICT Association of Hungary (IVSZ) in collaboration with experts and related organizations, and later the Hungarian Government involved it (DAS2.0) to the Digital Welfare Program. DAS aimed to improve the profitability, reduce the environmental impact and increase sustainability of the Hungarian agriculture according to the digitalization, robotisation through agricultural innovations in machinery. The main goals of the DAS are to (i) improve yield and quality according to more efficient while reducing waste (ii) reducing the risk of production according to DSS and (iii) reducing the sales risk. The authors of the DAS (government, non-governmental organizations, actors of the digital “ecosystem”) aimed to widen the application of PF solutions in the following areas: arable crop production, animal husbandry, horticulture, viticulture, fishing and forestry<sup>1</sup>. Development of the DAS1.0 was done in 3 phases and 6 steps<sup>2</sup>, where the first phase authors evaluated the present situation and opportunities in the context of the national vision of agriculture. The second phase based on the national vision of e-agriculture, the action plan, and on the monitoring and assessment plan. The last third phase was the development of the Digital Agriculture Strategy. According to the methodology designed, there are 5 areas which collaboration improves the efficiency: production, farm, production chain, specialist system and government. The final document provided by the IVSZ was introduced in press (06.19.2016) and at several events. Compared to the DAS1.0 the later version (DAS2.0) defined 5 pillars (in stead of the 5) namely: production, farm and production chain as main elements.

DAS is an important component of Hungary’s **Food Industry Concept 2017-2050** which goals were introduced in the D.T1.1.2 Precision farming policy economic review analysis.

DAS was supported by several other actions for example the **Digital Agrarian Academy** aimed to improve the knowledge of the farmers and interested audience in digital agricultural

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<sup>1</sup> DAS – Digital Agriculture Strategy of Hungary <https://digitalisjoletprogram.hu/en/content/das-digital-agriculture-strategy-of-hungary>

<sup>2</sup> Varga, P. (2018): Development process of a national Digital Agriculture Strategy: An example in Hungary. Gödöllő



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solutions. This project is supported by the Government according to the Innovációs és Technológiai Minisztérium, illetve a Digitális Jólét Nonprofit Kft..

According to the DAS higher education has high importance to introduce digital solutions and the benefit of PF to both the young generation and those who already run a farm. For this reason, MATE, together with several other Hungarian universities, participated in the renewal of Hungarian higher education in accordance with Government Decision 1785/2016. (XII.16.) on the adoption of the "Change of Pace in Higher Education Medium-Term Policy Strategy 2016". This process reached a decisive milestone on 1st February 2021, when the integration of higher education and research at our university was completed by the integration of eleven research institutes and several business organizations, and the new foundation model of maintaining came into being.

The main goal of the **Digital Welfare Program (DWP)** is to ensure that the development of curricula is carried out by the best professional workshops and colleagues available in Hungary - taking into account the specialization aspirations of the government concerning agricultural higher education. This goal can only be fully achieved in cooperation with several universities, including the three model change universities agreed on 1 April by the DWP. According to this Hungarian University of Agriculture and Life Sciences (MATE), the Széchenyi István University (SZE) and the University of Veterinary Medicine Budapest (ÁOTE) joint to a consortium to the development of the DAA curriculum.

### **Digital Agrarian Academy has the following modules<sup>3</sup>:**

- E-learning: Within the framework of the Digital Agrarian Academy, continuously expanding educational materials were prepared for those interested. There are currently 30 topics available in the 9 modules below. Additions were made to each topic for producers in the surrounding Carpathian Basin countries. The curriculum is constantly being developed based on changes in technology and user feedback, opinions and needs.
- Knowledge base / Definitions where those expressions are explained which linked to the precision agriculture.
- Digital Demonstration Farms: Understanding digital solutions is the most effective in practice, during operation. Lectures, exhibitions, and knowledge bases help a lot, but a good solution that works well and the honest experiences associated with it provide the most support for an informed decision. Demonstration farms will play a major role in training the farmers. In the framework of the Digital Agricultural Academy, the Digital Demonstration Farms would be selected.

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<sup>3</sup> <https://www.digitalisagrarakademia.hu/>



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- Digital Service Provider Database Survey: The purpose of creating a digital service provider database is to provide the “students” of the Digital Agricultural Academy with a unified structure about which service provider to turn to if they are looking for a special service provider to facilitate digitization or to build a complex system. The purpose of the database is to help farmers find the best service provider for them to help them implement digital solutions
- Digital public services: This catalog of digital services and online databases operated by the public sector in the agricultural sector. The list is constantly being updated and expanded.

	Topics of DAA (Hungarian)	Topics of DAA (titles in English)*
<b>I.</b>	<b>Farm menedzsment modul</b>	<b>Farm management module</b>
1	Agrár digitális alapismeretek	Basics of digital agriculture
2	Digitális farm menedzsment	Digital farm management
3	Digitális technológia és jog	Digital technology and law
4	Agrár adat felhasználás	Use of agricultural data
5	Digitális megoldások a vidékfejlesztésben	Digital solutions in rural development
<b>II.</b>	<b>Szántóföld modul</b>	<b>Arable plant production module</b>
6	Precíziós szántóföldi növénytermesztés	Precision crop production
7	Precíziós növényvédelem	Precision plant protection
8	Gyakorlati Talajtan gazdálkodóknak	Practical Soil Science for Farmers
9	Talajerőgazdálkodás a gyakorlatban	Soil resource management in practice
<b>III.</b>	<b>Állattenyésztés modul</b>	<b>Livestock module</b>
10	Precíziós állattenyésztés	Precision animal husbandry
11	Precíziós állattenyésztés (szarvasmarha, baromfi)	Precision farming (cattle, poultry)
12	Precíziós méhészet	Precision apiary
13	Precíziós aquakultúra	Precision aquaculture
14	Állategészségügy	Animal health
15	Takarmány	Forage
<b>IV.</b>	<b>Kertészet modul</b>	<b>Horticulture module</b>
16	Precíziós kertészet, zöldség, szántóföldi és üvegház	Precision horticulture, vegetables, arable crops and greenhouses
17	Kertészet gyümölcs	Horticulture, fruit growing
<b>V.</b>	<b>Szőlészet modul</b>	<b>Viticulture module</b>
18	Precíziós szőlészet	Precision viticulture
<b>VI.</b>	<b>Erdészet modul</b>	<b>Forestry module</b>
19	Precíziós erdészet	Precision forestry
<b>VII.</b>	<b>Precíziós gépek modul</b>	<b>Precision machinery module</b>
20	Precíziós gépek üzemeltetése	Operation of precision machinery
21	Robotok a mezőgazdaságban	Robots in agriculture



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22	Prediktív gép karbantartás és szervizelés	Predictive machine maintenance and service
<b>VIII.</b>	<b>Távérzékelés modul</b>	<b>Remote sensing module</b>
23	Drón használat	Use of drone
24	Monitoring drón	Monitoring drone
25	Munkavégzésre alkalmas drónok (permetező drón)	Drones suitable for work (spraying drone)
26	Műholdas távérzékelés	Satellite-based remote sensing
<b>IX.</b>	<b>Digitális Termelői Piac modul</b>	<b>Digital Producer Market Module</b>
27	E-kereskedelem és sharing economy az agráriumban	E-commerce and sharing economy in agriculture
28	Élelmiszeripar, minőségbiztosítás (digitális nyomonkövetési rendszerek)	Food industry, quality assurance (digital tracking systems)
29	Életmód, táplálkozás	Lifestyle, nutrition
30	Elsődleges termelői feldolgozás higiéniája	Hygiene of primary producer processing

\*Learning materials of the Digital Agrarian Academy is in Hungarian language, here we provide the English translation of the titles only

## What is the Intelligent Specialization Strategy (RIS3)?

*“Conceived within the reformed Cohesion policy of the European Commission, Smart Specialisation is a place-based approach characterised by the identification of strategic areas for intervention based both on the analysis of the strengths and potential of the economy and on an Entrepreneurial Discovery Process (EDP) with wide stakeholder involvement. It is outward-looking and embraces a broad view of innovation including but certainly not limited to technology-driven approaches, supported by effective monitoring mechanisms.”<sup>4</sup>*

According to the European Commission Smart Specialization Platform Hungary has two S3 thematic platforms:

- Artificial Intelligence and Human Machine Interface (AI & HMI)
- SME integration to Industry 4.0

The main S3 priorities are:

- Clean and renewable energies
- Healthy local food
- Inclusive and sustainable society
- Healthy society and wellbeing
- Agricultural innovation

<sup>4</sup> What is Smart Specialisation? <https://s3platform.jrc.ec.europa.eu/what-we-do>



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- Sustainable environment
- ICT and information services
- Advanced technologies in the vehicle and other machine industries

Concerning the Transform4.0 there are 3 priorities *Agricultural innovation*, *Sustainable environment*, and *Advanced technologies in the vehicle and other machine industries*.

According to the Smart Specialisation Platform<sup>5</sup> these priorities described as:

- Agricultural innovation:

The aim of the priority is to advance and establish the innovations facilitating sectoral renewal from the agricultural knowledge centres through producer undertakings to individuals, with the aim of enhancing the innovation potential of the sector. Such complex agribusiness developments should be implemented that represent an opportunity to use innovative R&D solutions in crop production and protection technologies, in addition to animal production and veterinary medicine.

- Sustainable environment:

The priority is aimed at promoting the sustainability of the environment and natural resource management (e.g. environmental biotechnology) through the research and development of modern technologies and the implementation of the environmental industry and sectoral innovation. In addition to the advanced innovative water treatment technologies and waste water treatment and waste management, priority will be given to the non-pipe technologies.

- Advanced technologies in the vehicle and other machine industries:

This is a priority which covers several segments of the machine industry RDI, whose priority (but non- exclusive) objective is to develop the vehicle industry from the development of vehicle components to the different branches of machine production (including, but not limited to, agricultural, food processing, precision and household machinery).

## National Smart Specialization Strategy of Hungary

Hungarian S3 objectives are introduced in the National Smart Specialisation Strategy published in November 2014<sup>6</sup> and in July 2021<sup>7</sup>. Earlier version includes a situation analysis details the general situation of Hungary, in more particular society, sustainability, GDP and added value. Within the RDI status it introduces the results from 2014, where Hungary was considered as a

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<sup>5</sup> <https://s3platform.jrc.ec.europa.eu/region-page-test/-/regions/HU>

<sup>6</sup> National str. 2014

<sup>7</sup> National strategy



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moderately innovative country. As one of the main factors of innovation higher education research organizations were analyzed. Results showed that health science, natural sciences and technical sciences are the most important areas. Linked to the Transform4.0 project the agricultural science showed lower importance with 9% of the distribution of the R&D expenditures of higher education by areas of science. Concerning the collaboration between higher education research institutions and companies the highest was in the area of agricultural sciences, as more than 50% of the projects are carried out in collaboration. Hungarian Academy of Sciences is one of the major actor in research and development in this way its role was also evaluated. According to the distribution of expenditures in the major research projects of the HAS by areas of science material sciences within the technical sciences and the physical and biological sciences within the natural sciences have the highest shares, while cultivation, horticulture, forestry and hunting received only a minor share (0.8%) of the expenditures, while according to the distribution of expenditures in the major research projects of the HAS by sectors, agriculture forestry and fishing received higher (4.2%) share. Results of the National Smart Specialisation Strategy showed that the large companies spend 30% more on research and development than the micro, small and medium sized enterprises. The expenditure was different according to the sectors: expenditure per researcher was the highest in manufacture of pharmaceuticals, medical chemical and botanical products. Linked to the Transform4.0 project it is important to highlight manufacture of machinery and equipment had high expenditure too. Report showed the proportion of the innovative companies are the highest (more than 70% of the companies were considered as innovative) in the manufacture of pharmaceuticals, medical chemical and botanical products, while less than 40% was in the case of manufacture of machinery and equipment. The report introduces the international outlook and international trends and among others the relations with the neighboring countries. SWOT analysis details the Strengths Weaknesses Opportunities Threats concerning the (i) education, training, research background, (ii) research and innovation environment, organisations, infrastructure and services, and (iii) financing. The report introduces governance structure within this the national processes before the National Smart Specialisation Strategies and the S3 stakeholders. Both triple helix and quadruple helix grouping of actors were designed, according to the following structure of the actors:

- Science
  - Higher education institutions
    - Universities
    - Colleges
  - Research institutes
    - Academic and sectoral (public or private) research institutes
  - Knowledge centres



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- Regional and sectoral knowledge centres
- Government
  - Government and local government organisations
    - Ministries
    - National government offices
    - County governments
    - County government offices
    - Local governments of cities of county rank
- Economy
  - Innovative enterprises
  - Large enterprises
  - SMEs (including micro, start-up and spinoff businesses)
  - Non-profit companies
  - Technology transfer organizations and accredited clusters
    - Innovation and technology transfer offices
    - Clusters
- Civil organisations
  - Trade associations
  - Interest representation bodies (e.g. national and county chambers of commerce and industry)
  - Other non-profit organisations

National priorities in the phase (2014-2021) divided into sectorial priorities and horizontal ones.

The sectorial priorities are:

- Healthy society and wellbeing
  - understanding diseases, early diagnosis, advanced medical and instrumental therapies, clinical methods, pharmaceutical, research and development, innovative health industry and health, tourism solutions
- Advanced technologies in the vehicle and other machine industries
  - machine industry RDI, advanced production technology systems, advanced materials and technologies (technical materials science, materials technology, nanotechnology, mechatronics and electronics))
- Clean and renewable energies
  - green energy - renewables and bio-energy, nuclear energy, energy efficiency
- Sustainable environment
  - natural resource management, advanced environmental technologies
- Healthy local food
  - food processing, locally produced and processed food of high added value
- Agricultural innovation
  - agriculture, forestry, hunting, aquaculture and water management, horticultural technologies, agricultural biotechnology





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The horizontal priorities are:

- ICT (infocommunication technologies) & Services
  - infocommunication technologies in support of the sectoral priorities, infocommunication technologies and services
- Inclusive and sustainable society, viable environment
  - education and training, health-conscious education and, prevention, awareness raising, promoting entrepreneurial skills, development of cooperation, networking, organization and management development, social innovation, connection to local and regional development programmes, regional development, tourism

National selected priorities - selected from a first stage of prioritization - in the latest version of the S3 (2021-2027) introduced according to a priority description, identification of the target sectors, areas for development, and priority objectives.

National economic priorities

- Cutting-edge technologies
- Health priority
- Digitisation of the economy priority
- Energy, climate priority
- Service priority
- Resource-efficient economy priority
- Agriculture, food priority
- Creative industries priority

These selected priorities are supported by the following horizontal priorities:

- Training, education
- Public sector and university innovation priority

The opportunities for the PA proposed in the S3 Hungary -2021-2027 highlighted the smart agri-food priorities

In relation to the Transform4.0 project **cutting-edge technologies** and **agriculture, food** national selected priorities have the closest relevance. Former one aims to develop - among others- cutting-edge technologies such artificial intelligence, big data, and AI-based data analysis. These technological innovations are in line with the aims of the Transform4.0 project pilot actions where data evaluation innovations support the growers to make arable crop cultivation, fruit growing or viticultural decisions. In our relation, these innovations would help



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the growers to reduce environmental impact, to increase the yield and improve the quality. In more particular, decision support system would provide benefit in planting, sowing, nutrient supply, plant protection (spraying), harvest, canopy management. In the agriculture, labor-shortage is a more frequent difficulty in many sectors. In viticulture pruning, canopy management, cover crop maintenance and harvest are the main operations where mechanization, automatisisation, robotics, and decision support systems are useful innovations. According to the S3 strategy the target groups of this priority are the universities, research institutes, businesses, non-profit sector.

The main objectives of this priority are the following ones, all would be linked to PA:

- Hungary should be close to the European forefront in research on cutting-edge technologies.
- As much as possible of the experimental development of cutting-edge technology research should take place in Hungary
- Establish and operate research networks and promote cross-sectoral, knowledge transfer collaborations to research and develop cutting-edge technologies
- Research infrastructures support the commercialisation of research results related to cutting-edge technologies, with a focus on applied research
- Improve the uptake of cutting-edge technologies by small and medium-sized enterprises
- Strengthening skills development support services for the effective use of cutting-edge technologies
- Supporting initiatives to enable sharing and cross-sectoral sharing to increase access to available cutting-edge technology infrastructures

**Agriculture, food priority** are even closer to the purposes of the Transform4.0 as, this priority covers many sectors of the agri-food chain for example: horticultural technologies, where viticulture belongs. The description of this priority highlights the effect of the climate change as one of the most important driving force of the innovations and technology development. Adaptations and solutions in this way essential in this sector. This goal is in line with the Transform4.0 objectives as the common pilot action preformed by the MATE, Linz Center of Mechatronics and AgriIT is aims to provide information for the irrigation planning and maintenance, and terroir evaluation. Both topics are related to the climate change. In Hungary the annual average precipitation is 500-750 mm, but the wine regions receive different amount of rain during a year, and year-to-year effect is also remarkable. According to the different scenarios irrigation and other treatments against the drought stress would be necessary to be applied. In viticulture rootstocks, training and trellising systems, special canopy management,



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and irrigation would be applied. In the Transform4.0 Big and Smart Data Management Pilot action case study 3: Sensor data acquisition for precision Viticulture in a fiware data lake we test a remote sensing network based on different sensors to provide information to the growers in the evaluation of their terroir and maintain any kind of viticultural operation based on microclimatic analysis.

The primary target group of the agriculture, food priority are agriculture, manufacture of food, beverages and tobacco products, manufacture of machinery and equipment.

Linked to the aims of the Transform4.0 the main objectives of this priority are:

- Encourage the widespread dissemination of innovative solutions and innovative agricultural technologies for a shift towards sustainable agriculture and a bio-based economy, in particular in the areas of water and nutrient demand and solutions to reduce the environmental impact of crop protection interventions
- Experimental applications of agricultural technologies for climate change adaptation to enhance the resilience of domestic crop and livestock production

Horizontal S3 priorities are the *training, education* and *public sector and university innovation* priority. Transform4.0 is in line with both priorities. According to the *training, education* sufficient number of skilled workforce is required to reach the objectives of the national priorities. A possible solution is the collaboration between the training centers and companies to give practical training. Implementing training activities linked to the smart specialization is also aimed. Primary target groups of the priority: universities, research institutes, vocational training centres and institutions, businesses, non-profit sector. The *university innovation* priority aims to strengthen the innovation capacity and innovation activities of among others universities, non-profit organizations and research institutes.

## The financial envelope for each development trajectory

According to the EU funding programmes<sup>8</sup> there are several programs financed by the EU budget or NextGenerationEU linked to research, for example in the heading Single Market, Innovation and Digital Horizon Europe, while in the European Strategic Investments there is the Digital Europe program. Within the Regional Development & Cohesion the European Regional Development Fund (ERDF)<sup>9</sup> provides funding to support investments for example for digitization and digital connectivity (within this for example the Interreg<sup>10</sup>). Natural Resources

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<sup>8</sup> [https://ec.europa.eu/info/funding-tenders/find-funding/eu-funding-programmes\\_en](https://ec.europa.eu/info/funding-tenders/find-funding/eu-funding-programmes_en)

<sup>9</sup> [https://ec.europa.eu/info/funding-tenders/find-funding/eu-funding-programmes/european-regional-development-fund-erdf\\_en](https://ec.europa.eu/info/funding-tenders/find-funding/eu-funding-programmes/european-regional-development-fund-erdf_en)

<sup>10</sup> [https://ec.europa.eu/regional\\_policy/en/funding/erdf/#1](https://ec.europa.eu/regional_policy/en/funding/erdf/#1)



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The Environment heading also contains those programs, which are linked to agriculture. For example the “two pillars” of the Common agricultural policy funds the European agricultural guarantee fund (EAGF) and European agricultural fund for rural development (EAFRD). Later one RDPs consist of measures and projects that contribute to the EU-wide objectives of<sup>11</sup>:

- improving the competitiveness of agriculture
- encouraging sustainable management of natural resources and climate action
- achieving a balanced territorial development of rural economies and communities

There are six EU rural development policy priorities (, that provide the support from the EAFRD to rural areas<sup>12</sup>:

### Priority 1: Knowledge Transfer and Innovation

FA 1A: Fostering innovation, cooperation and the development of the knowledge base in rural areas;

FA 1B: Strengthening the links between agriculture, food production and forestry and research and innovation;

FA 1C: Fostering lifelong learning and vocational training in the agricultural and forestry sectors.

Priority 1: Knowledge Transfer and Innovation			
Focus Area 1A Fostering innovation, cooperation, and the development of the knowledge base	Focus Area 1B Strengthening the links between agriculture, food production and forestry and research		Focus Area 1C fostering lifelong learning and vocational training
Percentage of expenditure under Measure 1 - Knowledge transfer, Measure 2 - Advisory services and Measure 16 - Cooperation in relation to the total expenditure for the RDP	Total number of cooperation operations supported under the cooperation measure	Total number of EIP Operational Groups supported out of the total number of cooperation operations	Total number of participants trained under Measure 1 - Knowledge transfer
3.6%	470	70	46 400

### Priority 2: Farm Viability and Competitiveness

FA 2A: Improving the economic performance of all farms and facilitating farm restructuring and modernisation;

FA 2B: Facilitating the entry of adequately skilled farmers into the agricultural sector and generational renewal.

<sup>11</sup> [https://ec.europa.eu/info/funding-tenders/find-funding/eu-funding-programmes/european-agricultural-fund-rural-development-eafRD\\_en](https://ec.europa.eu/info/funding-tenders/find-funding/eu-funding-programmes/european-agricultural-fund-rural-development-eafRD_en)

<sup>12</sup> [https://enrd.ec.europa.eu/policy-in-action/rural-development-policy-figures/priority-focus-area-summaries\\_en](https://enrd.ec.europa.eu/policy-in-action/rural-development-policy-figures/priority-focus-area-summaries_en)



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Priority 2: Farm Viability and Competitiveness			
Focus Area 2A Farm's performance, restructuring		Focus Area 2B Entry of skilled/younger farmers	
No. of agricultural holdings supported	Percentage of agricultural holdings supported	No. of young farmers supported	Percentage of young farmers supported
4 800	1%	3 000	1%
Planned expenditure		Planned expenditure	
460 million €		256 million €	

**Priority 3: Food Chain Organisation and Risk Management**

FA 3A: Improving competitiveness of primary producers by better integrating them into the agri-food chain;

FA 3B: Supporting farm risk prevention and management.

Priority 3: Food Chain Organisation and Risk Management			
Focus Area 3A Improve competitiveness of primary		Focus Area 3B Farm risk prevention and management	
No. agricultural holdings receiving support for participating in quality schemes, local markets and short supply circuits, and producer groups/organisations	Percentage of agricultural holdings receiving support for participating in quality schemes, local markets and short supply circuits, and producer groups/organisations	No. of agricultural holdings participating in risk management scheme	Percentage of farms participating in risk management schemes
26700	5%	15208	3%
Planned expenditure		Planned expenditure	
656 million €		116 million €	

**Priority 4: Restoring, Preserving and Enhancing Ecosystems**

FA 4A: Restoring, preserving and enhancing biodiversity;

FA 4B: Improving water management;

FA 4C: Preventing soil erosion and improving soil management.

Priority 4: Restoring, Preserving and Enhancing Ecosystems					
Focus Area 4A Restoring, preserving and		Focus Area 4B Improving water management		Focus Area 4C	
Percentage of agricultural land under management contracts supporting biodiversity and/or landscapes	Percentage of forest/other wooded area under management contracts supporting biodiversity	Percentage of agricultural land under management contracts to improve water management	Percentage of forestry land under management contracts to improve water management	Percentage agricultural land under management contracts to improve soil management and/or prevent soil erosion	Percentage of forestry land under management contracts to improve soil management and/or prevent soil erosion
11.8%	5.1%	3.6%	0.6%	8.4%	0.8%



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### Priority 5: Resource-efficient, Climate-resilient Economy

FA 5A: Increasing efficiency in water use by agriculture;

FA 5B: Increasing efficiency in energy use in agriculture and food processing;

FA 5C: Facilitating the supply and use of renewable sources of energy;

FA 5D: Reducing greenhouse gas and ammonia emissions from agriculture;

FA 5E: Fostering carbon conservation and sequestration in agriculture and forestry.

Priority 5: Resource-efficient, Climate-resilient Economy									
Focus Area 5A Increase efficiency in water use by agriculture		Focus Area 5B Increase efficiency in energy use in agriculture and food processing	Focus Area 5C Facilitate the supply and use of renewable sources of energy, of by-products, wastes and residues and of other non food raw material, for the purposes of the bio-economy	Focus Area 5D Reduce greenhouse gas and ammonia emissions from agriculture				Focus Area 5E Foster carbon conservation and sequestration in agriculture and forestry	
Irrigated land switching to more efficient irrigation system (ha)	Percentage of irrigated land switching to more efficient irrigation system	Total investment for energy efficiency (mill EUR)	Total investment in renewable energy production (€)	Agricultural land under management contracts targeting reduction of GHG and/or ammonia emissions (ha)	Percentage of agricultural land under management contracts targeting reduction of GHG and/or ammonia emissions	No. of Livestock Units (LU) concerned by investments in live-stock management in view of reducing GHG and/or ammonia emissions	Percentage of LU concerned by investments in livestock management in view of reducing GHG and/or ammonia emissions	Agricultural and forest land under management to foster carbon sequestration/conservation (ha)	Percentage of agricultural and forest land under management contracts contributing to carbon sequestration and conservation
6 000	6%	888	38	-	-	35 000	1%	40 000	1%
Planned expenditure 40 million €		Planned expenditure 401 million €	Planned expenditure 15 million €	Planned expenditure 18 million €				Planned expenditure 155 million €	

### Priority 6: Social Inclusion and Economic Development

FA 6A: Facilitating diversification, creation and development of small enterprises, as well as job creation;

FA 6B: Fostering local development in rural areas;

FA 6C: Enhancing the accessibility, use and quality of information and communication technologies (ICT) in rural areas.

Priority 6: Social Inclusion and Economic Development							
Focus Area 6A Diversification and job creation	Focus Area 6B Foster local development					Focus Area 6C Access to and quality of ICT	
No. of jobs created in supported projects	Net population benefiting from improved services	Rural population covered by local development strategies	Percentage of rural population covered by local development strategies	Percentage of rural population benefiting from improved services/ infrastructures	No. of jobs created in supported projects (LEADER)	Net population benefiting from improved services	Percentage of rural population benefiting from new or improved services/infrastructures (ICT)
4 000	5 530 000	5 530 000	68%	68%	500	-	-
Planned expenditure 283 million €		Planned expenditure 471 million €				Planned expenditure -	

## Lessons learned from the Transform4.0 experience

We consider that the precision farming have high importance in both European and national level in Hungary. New technological solutions would increase the yield and reduce environmental impact of agriculture. Caused by different factors for example climate change, labor-shortage or new EU regulations, different agricultural challenges should be solved by the farmers with the active contribution of technology providers, research institutions, universities and policymakers etc. One of the possible solutions is the agricultural digitalization and those innovative technologies, which are included in the PA.



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Results of the Transform4.0 project showed that there are several factors, which influence the spread of the precision farming technologies in Hungary. In line with previous findings, farm size is a critical factor. We found that larger farms are more open and more suitable/open for PA solutions, than those with small area are. Age of the growers are also a main factor as younger generation are more open to the new innovative solutions, and learn about those.

According to the SWOT analysis carried out in the Transform4.0 project, we found that some of the main weaknesses are the missing competence in response to EU calls and that the farmers are linked to their traditional methods, which later is usually linked to their age.

Transform4.0 showed that farmers need the interpretation of the technological innovations in more detailed. The Digital Agricultural Academy is one of the solutions to solve this problem, as model farms are involved to show the effectiveness and benefits of the new innovative technologies in practice, and experts are involved from several sectors of the agriculture to introduce new methodologies. As DAA includes learning modules it give the possibility to give deeper insight to the theoretical part of the precision farming solutions.

According to the feedbacks from high-schools, technical schools and university students and teachers education of the PA solutions have high importance in this way further courses and practical trainings are suggested to include in the curricula of the agricultural educations.

According to the Transform4.0 transnational collaboration with the partners we consider that cross-country collaborations are powerful in the research linked to the precision farming, in this way further funds support these kind of collaborations would be beneficial.

## Conclusions and recommendations for policy makers

We concluded that the role of the education in high-school and university level is important, in this way PA should be involved more in the curricula of agricultural and horticultural courses. Running programs linked to PA for example Digital Agricultural Academy in Hungary should be continued to give a deeper insight to the PA solutions to farmers.

Cross-country collaborations provide powerful environment in regional research programs, in this way these funds would have high importance in the future. More frequent interpretation of the EU calls and the introduction of the application process is beneficial.