SMARTLABOR

Strengthening Alliances for Policy Development and Testing in the domain of Innovation, Digitalization, and the Labour Market in the Western Balkans

Innovative platforms driving agricultural innovation, knowledge transfer and business development in the Western Balkans

- a case study

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Disclaimer

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1. INTRODUCTION

With the increasing pressure of complex challenges including climate change, environmental degradation, evolving consumer demands, rural depopulation and the urgent need for sustainable rural development, innovation seems to be the only path forward for transforming global food systems. *Innovation platforms* as structured spaces and/or mechanisms that bring together diverse stakeholders to co-create, adapt, and transfer knowledge and technologies are emerging as critical tools for fostering necessary agricultural transformation. These platforms play a key role in enabling horizontal collaboration, facilitating access to knowledge, and bridging the gap between research, policy, and practice.

This **research explores the role of innovation platforms in promoting innovation, technology and knowledge transfer, and business development in the agricultural sectors of the Western Balkans**. It aims to identify and analyze exemplary initiatives that have successfully contributed to agri-food sector advancement and digitalization, with particular focus on their **organizational models, functional approaches, and effectiveness in supporting farmers, agribusinesses and agri-food startups**.

By providing a structured comparison of these platforms, this **research contributes to a better understanding of success factors, contextual adaptations, and potential for replication**. It also offers **concrete insights for policymakers, development actors, and practitioners** working to enhance the resilience, productivity, and sustainability of agri-food systems in the Western Balkans.

This report, focusing on the Western Balkans Six (WB6), is **part of a broader research initiative** that investigates the conditions for effective digital knowledge transfer in agriculture and skills required for this transformation. Central to this effort is the analysis of five critical and interconnected pillars: the entrepreneurial sector, investment and capital providers, education and research institutions, corporate actors, and public bodies. These pillars collectively shape the ecosystem through which innovation and knowledge circulate across the region's agricultural landscape.

An **extensive mapping of stakeholders** in these domains across the six WB economies (Serbia, North Macedonia, Albania, Kosovo, Bosnia & Herzegovina, Montenegro) helped identify context-specific challenges, gaps, and promising practices. This process was **instrumental in selecting the innovative platforms featured in this report** as potential models for knowledge transfer, business development, and technological advancement in agriculture.

The **research is carried out within the framework of the SMARTLABOR project**, led by the Public Policy Research Center (CENTER) from Serbia, in partnership with CREDI (Bosnia and Herzegovina) and IMPETUS (North Macedonia). The project is implemented with the support of the "*SMART Balkans – Civil Society for Shared Society in the Western Balkans*" program, funded by the Norwegian Ministry of Foreign Affairs. Through this collaborative regional approach, the initiative aims to generate evidence-based insights to foster inclusive, sustainable, and digitally driven agricultural development across the Western Balkans.

2. INNOVATION PLATFORMS: AN OVERVIEW

Innovation platforms are evolving forms of cooperation aimed at enabling innovation to respond to continuous changes affecting society, the environment, and the economy. Thus, the simplest and all-inclusive definition for innovation platforms would be "**a space for learning and change**"[1]. These platforms provide a collaborative environment where multiple stakeholders interact to co-create solutions, adapt to new conditions, and improve systems through knowledge, technology, and business innovation.

Different cooperation forms that can be considered as innovation platforms are results of many different variables present at certain ecosystem or locale, including:

- number and/or type of involved stakeholders (government bodies, companies, NGOs, R&D organizations, financial institutions and other),
- business model (alliances, commercial activities, non-for-profit benefits, public private partnerships),
- level of operations (local, regional, national, or international),
- innovation focus (knowledge, technology, business model),
- development vision (strategic or project scope, short-, medium- and long-term approaches)
- other factors such as methodology, funding sources, policy context, and initiation drivers.

In the Western Balkans, various innovation platforms have emerged as significant contributors to the development of the agricultural sector. Within regional stakeholder mapping SMARTLABOR project identified a total of 131 different stakeholders engaged in innovation-driven activities, out of which 73 of them had agriculture as key of one of core focus areas. Most of these 73 organizations act as a classic research and state funded institutes acting on a national level, however, the region is home to certain more advanced technology and innovation driven platforms with high level of relevance to regional innovation ecosystems, such as:

Platform Type	Typical Stakeholders	Innovation Focus	Scale	Relevance to Agriculture
Smart Villages	Rural communities, municipalities	Social & digital	Local/Regional	High
Living Labs	Academia, industry, citizens, government	Co-creation, user-driven	Local/European	High
Centers for Digital Agriculture	Academia, private sector, government bodies	Digital transformation	National	High
Innovation Centers	Entrepreneurs, startups, incubators	Business innovation	Local/Regional	Moderate–High
Technology Parks	R&D organizations, startups, corporations, government	R&D & commercialization	Regional/National	Medium–High
Technology Transfer Centers	Universities, extension services, government	Knowledge & tech transfer	National/Local	High

[1] Homann-Kee Tui, S., Adekunle, A., Lundy, M., Tucker, J., Birachi, E., Schut, M., Klerkx, L., Ballantyne, P.G., Duncan, A.J., Cadilhon, J.J. and Mundy, P. 2013. What are innovation platforms?

Smart Villages as a concept is mostly referred to rural development policy tools of the European Union, although there are some different approaches to what it actually is in the Western Balkans countries that are still not part of the European Union due to differing policy frameworks and development priorities. As a territorial tool of EU's rural development policy this concept aims to "*strengthen the socio-economic fabric of rural areas*" and to "*modernize agriculture and rural areas by fostering and sharing of knowledge, innovation and digitalization*".[2] As a platform, it is mostly local or regional initiative, comprised of rural community stakeholders, that via mostly bottom-up approach is trying to *explore practical solutions to the underlying challenges they face, take advantage of new digital technologies, introduce social innovations in rural services, establish new win-win relationships with urban areas, and implement activities which reinforce the role of rural areas in the transition to a greener, healthier and more caring society*.[3]

Similar to Smart Villages, the **Living Labs** as a concept is also mostly referred to a practice coming from European Union, although it is pioneered at the Massachusetts Institute of Technology (MIT) and has slightly different setups and definitions in different parts of the world. According to European Network of Living Labs (ENoLL)[4], "*Living Labs are open innovation ecosystems in real-life environments based on a systematic user co-creation approach that integrates research and innovation activities in communities and/or multi-stakeholder environments, placing citizens and/or end-users at the center of the innovation process*." Interestingly, the concept can refer to an organization (macro level), a project (meso level) or specific activities, methods and tools within innovation projects (micro level). Living labs foster co-creation and open innovation among the main actors of the Quadruple Helix Model (citizens, government, industry, academia), but what makes them truly outstanding is that they operate in the real-life setting of the end users (for example, farmers), infusing innovations into their real life instead of moving the users to test sites to explore the innovations. Agriculture and rural areas play very significant role in the current network of Living Labs in Europe.

Centers for Digital Agriculture are diverse centers of excellence for harnessing digital technologies to transform agriculture and empower farming communities via multidimensional approach that combines technical expertise, social understanding, and innovative partnerships. They are organized around single or multiple organizations coming from academia, research organization, private sector and government institutions. The term for such organization is not widely standardized and, depending on the country and ecosystems, such platforms are also named Center for Digital Innovation (Bosnia and Herzegovina), Digital Agriculture and Extension Centre (USA), Center for Precision Agriculture (Norway), Centers for Agriculture Innovations (UK), etc.

Innovation Centers are very common and globally known (physical) platforms or hubs designed to provide access to service and resources that are typically beyond the reach of small businesses and startups, such as expensive equipment, specialized training, and mentorship. They are characterized as a collaborative environment where entrepreneurs and small businesses can come together to exchange ideas, innovate, and develop their business ideas and projects. Common services in Innovation Centers are incubator and accelerator programs for startups and coworking spaces for entrepreneurs, freelancers, and remote workers, while advanced Innovation Centers offer research and development services, usually in collaboration with universities, government agencies, and private companies. Innovation Centers are usually

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[2] https://agriculture.ec.europa.eu/common-agricultural-policy/rural-development/supporting-smart-village-strategies_en

[3] EU Rural Review 26 'Smart Villages: Revitalising Rural Services', European Network for Rural Development, May 2018

[4] https://enoll.org/

sector agnostic, while some of them can have strategic preference to certain types of businesses.

Technology Parks (also known as *technopoles*, *research parks*, *science parks* or *science and technology parks*) are long-standing and widely known promotors of research and innovation in local, regional and national ecosystems. According to International Association of Science Parks and Areas of Innovation (IASP)[5], they are defined as "*organization managed by specialized professionals, whose main aim is to increase the wealth of its community by promoting the culture of innovation and the competitiveness of its associated businesses and knowledge-based institutions."* To ensure these goals are met, these platforms stimulate and manage the flow of knowledge and technology amongst universities, R&D institutions, companies and markets; facilitate the creation and growth of innovation-based companies through incubation and spin-off processes; and provide other value-added services together with high quality space and facilities. Previously mentioned Innovation Centers are often part of Technology parks, as well as Technology Transfer Centers elaborated in the next paragraph. According to UNIDO[6], the overall objective of the science and technology parks is to create favorable conditions for the formation and functioning of the innovation market. STPs leverage the joint effort of two distinct but usually separated economies – the research economy, driven by the creation of new knowledge, and the commercial economy, driven by the marketplace – to unlock the potential of the Fourth Industrial Revolution (4IR), with the aim of promoting the development and commercialization of innovative solutions developed locally. Although Technology Parks are often seen as industrial or tech oriented, agri-food sector is often part of their sector portfolio.

Similar to Centers for Digital Agriculture**, Technology Transfer Centers** are also diverse public, academic or commercial centers of excellence that promote innovation and facilitate knowledge and technology transfer by bridging the gap between research and practice. They can be stand-alone platforms or part of other innovation platforms. Also, their naming can be different in different ecosystem, like for example Office of Technology Transfer (USA), Centre for Agricultural Technology Assessment and Transfer (India) or Agricultural Technology Demonstration Center (Mozambique).

3. CASE STUDIES IN THE WESTERN BALKANS

In this section, six selected case studies of previously described advanced innovation platforms will be presented, one from each Western Balkan country. The presented cases are intended to highlight diverse models of innovation platforms operating in the agri-food sector. Each case is described using secondary sources of information and follows a consistent structure, covering:

- A general overview of the platform;
- Its role in innovation development in agriculture;
- Its contribution to technology and knowledge transfer; and
- Its approach to business and startup support.

[5] https://www.iasp.ws/

[6] https://ipp.unido.org/portfolio/science-and-technology-parks

These case studies provide the empirical basis for the comparative analysis in the following chapter.

3.1. SMART VILLAGE KNEŽICA – BOSNIA AND HERZEGOVINA

Full name	**Agricultural Cooperative "Smart Village" Knežica – Kozarska Dubica**
Type of organization	Cooperative
Active since	2021
Reach	Local
Founders	Private individuals
Website	https://www.smartvillage.rs.ba/

Smart Village Knežica is an innovation platform with a rather unique business model. Formed in 2021 as an agricultural cooperative by a group of experts primarily interested in research and development in agriculture, their setup and operation utilizes smart village concept, as well as *Digital Innovation Hub* and *Living Lab* methodology. Their goal is to build a common infrastructure for research and development, creating sustainable and innovative solutions tailored to the needs of the local community.

Their key activity areas currently include:

- Development of technological solutions for advanced agricultural practices;
- Establishment and management of experimental fruit and vegetable fields and vineyards;
- Community and rural development through project related funding (domestic and EU funds);
- E-business support to farmers.

While their cooperative model allows for commercial activities, their current operations are primarily funded through international and EU project grants. Despite being active for only four years, Smart Village Knežica has managed to get involved in several significant EU funded projects, under EU Interreg Danube program, Interreg IPA ADRION program, as well as to get financial support for their activities through bilateral programs of international organizations such as UNDP, US Embassy, and Embassy of Italy in BiH. A distinctive feature of their development model is an open, continuous call for investors interested in contributing to their infrastructural and program expansion. Their efforts have been recognized locally and further reinforced with on-going strategic partnership with Municipality of Kozarska Dubica and Ministry of Agriculture, Forestry and Water Management of Republika Srpska.

Contribution to innovation development in agriculture

Innovation development in agriculture plays a big role in overall structure and activity areas of Smart Village Knežica. Within their *Digital Farm*, situated on a land in the center of village of Knežica and leased to them by Municipality of Kozarska Dubica, the cooperative is transforming neglected land into **experimental fields** with an aim to regenerate and conserve agricultural land through environmentally responsible practices. These activities are done in partnership with Ministry of Agriculture, Forestry and Water Management of Republika Srpska and Faculty of Agriculture in Banja Luka. UNDP also supported these activities through their EU4Agri project by funding Smart Village Knežica's intervention *Development of a sustainable agritech ecosystem in the fruit and viticulture sector in northwestern BiH (ITree)* which experimented and demonstrated practical application of drones, use of biological plant protection products, development of advanced smart irrigation systems and introduction of resistant grapevine varieties. Development of award-winning **prototypes** for advanced agricultural practices in cooperation with companies, academia and extension services is another contribution to innovation of Smart Village Knežica. Notable examples are *selective application of plant protection agents based on plant detection using sensors*, *Aquaterrius* - integrated irrigation system for agricultural crops and concept of the *future passive greenhouse*. Their contribution to innovation development is also pursued through **research and development projects** funded through EU funds and implemented in cooperation with large number of partners from Europe. Most notable projects include *DFTB*[7] *- Supporting Agri-food communities and networks in SEE through developing services on digital food quality and traceability using blockchain (*Horizon 2020*)* led by Green Digital Innovation Hub (Green eDIH) from Romania and *FENESTRAE*[8] *- Fostering Energy Efficiency by means of Smart Technologies to Retrofit Apertures and Building Envelope* (Interreg IPA ADRION) led by Polytechnic University of Bari from Italy.

Contribution to technology and knowledge transfer in agriculture

Technology and knowledge transfer is another core pillar of this platform. They are continuously offering **educational courses and trainings** to farmers and students of local elementary and high-schools on an array of topics ranging from primary agricultural practices to advanced technological solutions. Examples of such trainings are: Organic production of fruits and vegetables (young farmers/entrepreneurs); Fruit nutrition (farmers); Greenhouse production of vegetables (experienced and young farmers); Use of drones in plant protection and nutrition (farmers); Automation, Robotics and Internet of Things; (Elementary Schools), Multimedia production (Elementary schools). These courses and trainings are organized in cooperation with numerous partners, such as extension service department and department for organic production of Ministry of Agriculture, Forestry and Water Management of Republika Srpska, regional agricultural cluster GLS, Network of young agripreneurs, local agricultural advisors, distributors of inputs and technology solutions, and local schools. Smart Village Knežica is also a frequent contributor to major **awareness-raising and knowledge exchange sessions** such as conferences, forums, public presentations and workshops, both in the country and in the Western Balkans. They also collaborate with European Training Foundation where they contributed to the report on future skills needs in the agri-food sector of the Western Balkans (2024), and Biosense Institute from Serbia with whom they cooperate on projects related to innovation, technology and knowledge transfer. In 2024, they launched an **informational web platform** called Agritech Magazin[9]. This platform aims to inform and educate farmers and rural

[7] https://www.smartvillage.rs.ba/portfolio/projekat-blockchain-sah/

[8] https://fenestrae.interreg-ipa-adrion.eu/

[9] https://mojeselo.tech/

residents on EU agricultural practices, new technologies in agriculture, entrepreneurial and agro-economic models, effects of climate change, R&D breakthroughs as opportunities, as well as public calls aiming support and inclusion of rural people and agribusinesses.

Contribution to business and startup development and support

Their *AgriTech Innovation Hub* offers to agri-businesses and farmers a comprehensive package of **advanced technology services** that integrates custom design of embedded IoT systems, remote sensing, computer vision, automation and robotics for improved agricultural processes. Within their Business Digitalization and Marketing Sector, Smart Village Knežica also offers **e-business services** to agricultural businesses, such as product presentation and branding, market research, SEO, CRM, e-commerce, as well as presentation service through exhibition and sales infrastructure on their premises. Rural **community building** and especially **support to youth, youth-led farms and agri-business startups** is one of the specific segments of interest for this platform. This is pursued through innovative projects such *Young people in the service of village digitization*[10], where the objective is to get young people out of their classrooms and support them in learning and applying practical digitalization knowledge on agricultural farms through a living lab concept. This project is also setting up a first educational rural maker space for technology and multimedia in Bosnia and Herzegovina. Second example is the on-going *Danube4Rural*[11] *project* (Interreg Danube program) focused on attracting highly skilled remote workers to rural areas facing depopulation.

Looking ahead, Smart Village Knežica is planning to establish a Smart Village Campus, an innovation platform in itself, which will offer multifunctional space for various educational services, rural maker space focused on areas such as machine learning, computer vision, Internet of Things (IoT) and precision agriculture, Co-working and Co-Living labs, and a special Food Hub dedicated to product development and testing of innovations in collaboration with local farmers as well as a catalyst for social entrepreneurship initiatives of small producers. Although still very young, Smart Village Knežica is a fluid and living innovation platform that is combining different concepts and methodologies in order to be a bridge between technology and agriculture, and continuously test and develop sustainable and innovative solutions for their community.

3.2. PA4ALL - PRECISION AGRICULTURE LIVING LAB - SERBIA

Full name	**PA4ALL - Precision Agriculture for All**
Type of organization	Unit of public R&D institute
Active since	2013
Reach	Transnational
Founders	BioSense Institute

[10] https://digitalnoselo.smartvillage.rs.ba/

[11] https://www.smartvillage.rs.ba/portfolio/danube4rural-com-integrisani-transnacionalni-model-upravljanja-za-prilagodjavanje-politika-ruralnih-zajednica-potrebama-radnika-na-daljinu-i-poslodavaca/

Website	https://biosens.rs/en/themes/living-lab

PA4ALL (Precision Agriculture for All) is a pioneering Living Lab established in 2013 by the BioSense Institute in Novi Sad, Serbia. It stands as the first Living Lab in Serbia and among the first in Europe dedicated to precision agriculture. PA4ALL serves as a collaborative platform and an open innovation ecosystem, bringing together farmers, agribusinesses, researchers, policymakers, schools, and ICT professionals to collaboratively develop, test, and implement precision agriculture solutions.

Their main activity areas:

- Promotion and adoption of precision agriculture tools across agricultural production chains, and support to policy makers in integrating them in national strategies.
- Real-world and real-time testing of precision agriculture innovations and tools though co-creation with an array of stakeholders and multidisciplinary collaborations.
- Popularization of agriculture among youth through educational reforms and introduction of ICT and precision agriculture in high school curricula.
- Promotion of broader societal adoption of ICT in agriculture.

By being part of Biosense Institute, PA4ALL is not an isolated unit, but rather a cross-connected section to all other units and labs of this organization. It is also a prominent member of European Network of Living Labs where it is often presented as a role model to newly established living labs. Their activities are mostly project driven, with funding coming from EU programs (FP7, Horizon 2020) and national public funding, however they are offering commercial services and product development on a partnership basis.

Contribution to innovation development in agriculture

As a living lab, PA4ALL is conducting **real-world and real-time testing of ideas and prototypes** that address practical challenges faced by the agricultural community. Their work is integrating advanced ICT technologies such as nanomaterials, low-cost miniature sensors, satellite imaging, robotics, and big data analytics. Testing is done directly at and by end users, entails interdisciplinary collaborations and co-creations (engineers, farmers, entrepreneurs, educators, and policymakers), and promotes open innovations – making them accessible and beneficial for a wide range of stakeholders, including marginalized or technologically underserved groups. Examples of their contribution to innovation can be seen practically in every project they implemented. In *ClieNFarms-Climate Neutral Farms project*[12] (Horizon 2020) their aim is to co-develop and upscale systemic locally relevant solutions (organizational, financial, technical) to reach climate neutral and climate resilient sustainable farms across Europe (and beyond), interactively integrating and improving existing solutions to achieve economically viable business models in farming systems by involving farmers, extension services, agri-food business, policy-makers, finance and citizens. The project is centered around a demonstration approach called the *Innovative Systemic Solution Space* (I3S), and based on 20 demonstration case studies selected with diversity in mind, in regard to the production systems (crops, cattle, dairy, special crop productions, etc.) and geographical situations. Another example is a project *ZeroW-Systemic Innovations Towards a Zero Food*

[12] https://clienfarms.eu/

Waste Supply Chain[13] (Horizon 2020) which aims to significantly impact food waste through creation of innovative solutions to reduce food waste in nine real-life food chains, and develop commercial, digital tools and instruments that contribute to the achievement of food waste reduction targets.

Contribution to technology and knowledge transfer in agriculture

All innovations and projects of PA4ALL are subject to technology and knowledge transfer. The very concept of a living lab entails that the **end users are actively involved in design and testing of new technologies**, and thus are subject of technology and knowledge transfer. Further on, due to open innovation principle in all activities of PA4ALL, all innovations generated are subject to open dissemination, either though **educational materials and free online services**, as well as through **workshops, fairs, trainings and events** aimed at sharing research outcomes and technological advances with a broader audience. Previously mentioned project *ClieNFarms-Climate Neutral Farms project* (Horizon 2020) is a good example of this, since it resulted with two very interesting knowledge repositories: the *Scaling Toolbox* and the *Catalogue of Climate Solutions*. The Scaling Toolbox is a set of solutions and tools for farmers, advisors and farming groups, private companies, reformers, champions, investors and policymakers on how to make changes on their land, through their investments or through their regulations. On the other hand, the Catalogue of climate solutions offers farm-level climate solutions that can reduce the climate impact of agricultural production systems in Europe. It provides information on and expected impact of practices and technologies aimed at reducing the climate impact of dairy cattle, pigs, beef cattle, arable crops, sheep, and perennial crops. All this is accompanied by a number of events promoting these solutions, through workshops, demo days at demonstration farms, on-line training sessions, webinars, study visits, and video materials. Contribution of PA4ALL to this segment is also seen through their activities dealing with **educational reforms and introduction of ICT and precision agriculture in high school curricula**. Not only are students familiarized with benefits of using the ICT in agriculture and encouraged to uptake new trends and innovations, but with instalment of precision equipment at schools such as meteostations, they are also encouraged to develop solutions that use precision data like soil humidity, air temperature, precipitation amounts, air humidity, wind direction. One example of practical solution is *SPRAYCONDI*, a digital advisor for the reduction of errors in the application of pesticides' conceptualized by the students of high school specialized in agriculture from Futog. Contribution to knowledge transfer is also seen in PA4ALL's activities that contribute to **shaping domestic and EU policies in regard to sustainable agriculture**. Their *ZeroW-Systemic Innovations Towards a Zero Food Waste Supply Chain* (Horizon 2020) project is directly contributing to the European Commission's ongoing legislative initiatives in the area of food waste reduction, while *SISCODE – Society in Innovation and Science through CODE*[14] (Horizon 2020) project aimed at stimulating the use of co-creation methodologies in policy design, using bottom-design-driven methodologies to pollinate Responsible Research and Innovation, and Science Technology and Innovation Policies. PA4ALL is also **building cooperation networks** that contribute to technology and knowledge transfer. Example of this was seen in *ALL-READY – The European Agroecology Living Lab and Research Infrastructure Network*[15] (Horizon 2020) project which prepared and piloted a European network of Living Labs (LL) and Research infrastructures (RIs) called "*AgroEcoLLNet*". This pilot network allowed real-life experimentation on the structuring and functioning of the future European network based on co-creative and participatory methods.

[13] https://www.zerow-project.eu/

[14] https://siscodeproject.eu/

[15] https://www.all-ready-project.eu/index.html

Contribution to business and startup development and support

Collaboration and co-creation principle of living lab, along with **end-user approach to testing** of innovations provide an excellent setup for involvement and contribution to businesses and startups. Through that approach, PA4ALL is building **synergies with agribusiness companies and startups**, encourages advanced agricultural entrepreneurship via modern agri-tech opportunities, and strengthens the local ecosystem by connecting end users to other collaborators involved in their research. The use of state-of-the-art precision equipment also leads to building **synergies with agri-business support companies** that commercially offer such products and solutions. The nature of digital solutions involved, also **involves ICT sector**. All these actors joined via open innovation ecosystem practices by PA4ALL as a living lab lead to regular contribution to business and startup development. A concrete example of such linkage and support was noted in project *FRACTALS -Future Internet Enabled Agricultural Applications*[16] (FP7). The main goal of the project was to support 60 small and medium enterprises and Internet entrepreneurs from European IT community, with a focus on the Balkans, in order to develop applications for the agricultural sector based on FIWARE technology. FIWARE technology is an open, public and royalty-free architecture and a set of open specifications for digital applications. The support was multidimensional and included: building the technical capacity of small and medium enterprises and Internet entrepreneurs, application testing and validation as well as mentoring support. Project *FRACTALS* won the silver medal in the Best Living Lab Project 2016 Award, organized by the European Network of Living Labs.

Broader impact of PA4ALL can be observed on two levels. On micro level, from the perspective of a Living Lab, its impact is can be seen in: influencing *agroecological transition* by connecting technological innovation with environmental sustainability and *ecosystem development* by showcasing successful co-creation models, advocating for curriculum reform, digitalization in agriculture and support to the establishment of new Living Labs in the region and beyond. On macro level, by being part of Biosense Institute, impact of PA4ALL contributes to all areas explored above by being integral part of institute's accelerator and several research and innovation centers (for sensing technologies, IT, biosystems, product development and innovation and business development) and playing significant role in development of state-of-the art digital solutions and patents, as well as providing support to public administration get a better insight into agricultural production, achieve more efficient control of the subsidies and detect irresponsible use of farmland.

3.3. CENTRE FOR DIGITAL AGRICULTURE (AGFUTURA TECHNOLOGIES) – NORTH MACEDONIA

Full name	**Centre for Digital Agriculture**
Type of organization	Private enterprise
Active since	2021
Reach	National

[16] https://biosens.rs/projects/future-internet-enabled-agricultural-applications

Founders	Private individuals
Website	https://agfutura.com/centre-for-digital-agriculture/

AgFutura Technologies is a private advisory company from Skopje, North Macedonia, specialized in advanced agricultural solutions and food systems. As a business entity, AgFutura offers commercial activities that are focused on agribusiness consultancy, professional advisory services and access to state-of-the-art agricultural equipment. By continuously positioning themselves as pioneers in using and promoting digital and precise technologies in agriculture, they saw the need to established a Centre for Digital Agriculture as a dedicated R&D and innovation platform within the company, focused on advancing the integration of modern technologies in the agricultural sector and among agricultural actors. This Centre focuses on three core areas:

- Research and development;
- Education and training;
- Data management and analysis.

The Centre was initiated in 2021 through a dedicated project funded by domestic Fund for Innovation and Technological Development, Ministry of Agriculture, Forestry and Water Management of North Macedonia and the Program for Increasing Marketable Employability (IME) financed by the Swiss Agency for Development and Cooperation. Initially, the Centre was focused on education and consulting for digital agriculture and precision agriculture with a high degree of applicability, and agrotechnical services for the implementation of precision operations using an unmanned aircraft. Over time, its role evolved and became more streamlined to better fit and work within overall company structure. Today, through the Centre, AgFutura Technologies actively engages with local agricultural communities, public bodies, and universities. This collaboration involves hosting workshops, conferences, and hands-on demonstrations to showcase the transformative potential of digital technologies in agriculture. By forming strategic partnerships with international (funding) organizations, AgFutura secures essential support for the widespread implementation of digital agriculture practices, emphasizing its commitment to advancing technology and innovation in the agricultural landscape.

Contribution to innovation development in agriculture

With its research and development role, the Centre is dedicated to **developing, testing, and evaluating technological solutions** in agronomy, agricultural economics, and digital agriculture. This involves creating and implementing tools that enhance agricultural productivity and sustainability. One of the prime results of such activities is a *Remote agricultural monitoring and advisory system – RAMAS*[17], a state-of-the-art solution that combines digital and precisions technologies that was developed and tested in several countries on diverse farmers levels and is now part of the business support offering of AgFutura. Contribution to innovation is also pursued in areas such as use of Unmanned Aerial Vehicles (UAVs) in agriculture through EU funded projects such as *ACCELERATE*[18] *- Advancing UAVs technology to enable monitoring for*

[17] https://agfutura.com/digital-agriculture/

[18] https://agfutura.com/project/accelerate/

a sustainable environment (Horizon-MSCA) and *ICAERUS*[19] *- Innovations and capacity building in agricultural environmental and rural UAV services* (Horizon Europe). One of key areas where the Centre and AgFutura Technologies are making effort in contributing to innovation is environmental protection through sustainable practices. Examples of this can be found in their flagship projects CARBONICA[20] - Carbon Initiative for Climate-resilient Agriculture (Horizon Europe), LegumES[21] - *Valorising and balancing the ecosystem service benefits offered by legumes, and legume-based cropped systems* (Horizon Europe) and VALERECO[22] - *Valorization Legumes Related Ecosystem Services* (Horizon Europe).

Contribution to technology transfer and knowledge transfer in agriculture

By recognizing the importance of knowledge dissemination at its inception phase, the centre is designing and delivering both **standard and specialized educational programs**. These programs are tailored to accommodate modern agricultural production technologies and are often enhanced by digital tools, addressing the specific needs of various stakeholders in the agricultural community. They are delivered either at testing and demonstration sites or online. Examples of such trainings deal with Soil analysis and carbon measurement, Monitoring of crop health, nutrition and irrigation, Crop harvest monitoring, Tools for digital and sustainable agriculture, and Digital farm management. With their diverse and extensive project portfolio, they actively collaborate with local agricultural communities, public bodies, and universities. This collaborative effort involves hosting a range of **workshops** and **conferences**, alongside providing hands-on **demonstrations** to highlight the transformative potential of digital technologies in agriculture. Contribution to knowledge transfer is also pursued with multi-stakeholder partnerships and projects such as CODECS[23] - *Maximising the co-benefits of agricultural digitalization through conducive digital ecosystems*, where the overall goal is to improve the motivation and the capacity of European farmers to understand and adopt digitalization as an enabler of sustainable and transformative change. On top of classic educational and awareness raising sessions, this project also launched a *Knowledge Accelerator*, an outreach instrument that organizes spaces for stakeholder exchanges and peer-to-peer learning to accelerate action through capacity building, as well as *CODECS digital platform,* a dynamic hub for showcasing cutting-edge digital tools and research, promoting technology adoption in line with a sustainable digital vision. Due to close ties with universities and agricultural faculties in the country and in EU, and being staffed with highly educated staff, the Centre is also authoring **research papers** on results and breakthroughs within their R&D and innovation-related activities.

Contribution to business and startup development and support

As a business entity, AgFutura Technologies is acting as a **commercial service provider** to agribusinesses, international organizations and local public authorities. Although the Center itself is not directly a division for commercial support offering, it is playing a key role in shaping the overall service offering of the company. Company's flagship commercial service, **Remote**

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[19] https://agfutura.com/project/icaerus/

[20] https://agfutura.com/project/carbonica/

[21] https://agfutura.com/project/legumes/

[22] https://agfutura.com/project/valereco/

[23] https://www.horizoncodecs.eu/

agricultural monitoring and advisory system – RAMAS, is a product developed internally within the scope of the Center. RAMAS provides accurate real-time monitoring and advisory services to farmers and agribusinesses by utilizing various on-site and off-site sensor configurations, including weather stations, soil sensors, and pest traps, combined with data from drones, satellites, and soil analyses. Via a such comprehensive overview it enables in-depth assessments of crop health, nutrition, and hydration across different farm types and production systems. The deployment of RAMAS is subject to detailed farm assessment addressing technological and economic capacity of clients. Based on that, a dedicated soil, sowing, phyto, nutri, irrigation and harvest programs are developed and provided. Further agribusiness services that they offer are related to agroeconomic segments such as **agribusiness strategy and implementation plans**, as well as **farm financing support**. The Centre continuously develops and maintains specialized agricultural databases that encompass technological, socioeconomic, and behavioral data. This comprehensive data management supports informed decision-making and strategic planning in agriculture. By **partnering with international organizations** such as USAID, GIZ and UNDP, both the Center and the company contribute to development of agribusinesses in the Western Balkan region by securing essential technical support for the widespread implementation of digital agriculture practices through pilot projects, capacity building and mentorship, and awareness-raising initiatives.

By combining Centre's commitment to development of innovative solutions adjusted to the needs and conditions of farmers in Western Balkans with commercial application and validation offered as a service by AgFutura Technologies, and further fueled by access to state-of-the-art innovation and R&D communities via EU funding mechanisms, this innovative platform is emerging as one of key Western Balkan's leaders in providing applicative expert support for sustainable and digitalized agricultural production.

3.4. TEHNOPOLIS - MONTENEGRO

Full name	**Innovation and Entrepreneurship Centre (IEC) Tehnopolis**
Type of organization	(Public) Company
Active since	2016
Reach	National
Founders	Government of MNE
Website	https://tehnopolis.me/

Innovation and Entrepreneurship Centre (IEC) Tehnopolis in Nikšić, Montenegro, is the leading hub for the development of innovative and startup companies in this country. Established by the Government of Montenegro, it plays a key role in shaping the national innovation ecosystem. It provides a wide range of infrastructural and support measures that enable the creation of new companies and the growth of businesses based on innovative ideas and technologies. As an innovation platform, it is mostly acting as sector-neutral, however, contribution to agricultural sector or more precisely smart agriculture, digitalization, and agricultural innovations do get significant attention both within internal structure and through pursued initiatives, such as:

- Hackathons and collaborative projects;

- Support to agricultural producers;
- Conferences and knowledge sharing;
- Laboratory facilities.

Key unit dealing with agriculture within Tehnopolis is their biotechnology laboratory (BioLab) established with the aim of supporting agricultural producers and agriculture in general, both by providing own services and by connecting the academia with business sector. As a national hub for innovation and entrepreneurship, Tehnopolis is one of key partners in development of new Smart Specialization Strategy of Montenegro (2026-2031), acts as a founding member of European Digital Innovation Hub MonEDIH, and plays major partner role in EU funded and regional Western Balkans projects focused on innovation, and research and development.

Contribution to innovation development in agriculture

Although very much focused on innovation in many different fields, Tehnopolis' contribution to this segment in agriculture is so far moderate. Main regular contribution can be seen within their TechLab where they support projects of innovators, students and SMEs in developing functional **prototypes** using CNC and 3D printing technologies. Some of the innovative projects developed include *Smart bee feeder* that allows bees to access and consume hygienically correct water and *Smart fish feeder* which enables an automated fish feeding process and thus optimizes food consumption. Irregular contribution to innovation can also be seen through various development projects implemented. Thought their TechLab and within project AWeS0Me[24] - *Agricultural waste as sustainable 0 km building material* (Interreg - IPA CBC), they established **pilot labs** to explore and promote usage of agricultural waste for the production of building materials with high energy efficiency. Similar contribution was done through a project FILA Plus[25] - *Strengthening and empowering of cross border innovation networks through Fertilization Innovation Labs in Agro-food for improving the connection between research and SMEs* (Interreg - IPA CBC) which explored and promoted different ways how agriculture can be driven by innovation. An additional way of contributing to innovation is through dedicated **hackathons**. As part of the VIRAL[26] project - *Vitalising ICT Relevance in Agricultural Learning* (Erasmus+), Tehnopolis organized a hackathon aimed at integrating agriculture with information technologies. This event facilitated collaboration between faculty, students, and the business sector to develop sustainable solutions for challenges faced by agricultural enterprises. Some of the developed solutions include *FIRM system* (Farmer Irrigation Remote Monitoring) and *ALAT* (Agricultural Labor Automatization Tool).

Contribution to technology and knowledge transfer in agriculture

Their contribution to technology and knowledge transfer in agriculture is mostly done through awareness-raising sessions such as **conferences and workshops**. These are mostly organized in correlation to services provided through their BioLab, as part of implemented projects, or in cooperation with relevant ministry or domestic organizations such as Network for Rural Development of Montenegro and Cluster of Agricultural Producers of Montenegro. Tehnopolis is also host to annual *Days of science and innovation* event and **fair**, where the main

[24] https://awes0me.italy-albania-montenegro.eu/

[25] https://fila.italy-albania-montenegro.eu/

[26] https://viralerasmus.org/en/home/#

goal is to promote advanced technologies and stimulate interest for their use in everyday life and work, especially among youth. This event attracts significant youth from rural areas and thus educates them on potentials of new technologies, including their use case that might be applied in agriculture. Within VIRAL project, Tehnopolis also participated in development and dissemination of a **Manual** for educators on the application of selected technological solutions in agriculture: robotics, GIS, use of drones, IoT, mobile applications, with intention to help agricultural producers master new technologies in their agricultural production.

Contribution to business and startup development and support

The strongest contribution to agriculture from this platform can be seen in regard to business and startup development and support. Through their BioLab, Tehnopolis is **supporting farmers and agribusinesses with commercial and subsidized services** such as: drone monitoring of the vegetation cycle, testing the technical correctness of machinery used for the application of plant protection products (atomizers and field sprayers), soil analysis, detection of pathogenic bacteria in food products of animal origin by PCR method and determination of antibiotics in milk by LC-MS/MS method. **Support to startups** is one of the main missions of this platform. This support is provided through their Business incubator, TechLab (equipped with state-of-the-art CNC and 3D printing technology), Data Center, pre-accelerator and accelerator programs, startups camps, and various pitching competitions. Due to agriculture's significance for the region of Nikšić, as well as vast rural areas of northern Montenegro, startup ideas focused on agri-food solutions are very common in regular initiatives and services implemented at Tehnopolis. Some of the successful startup stories include *Seljak.me* - website intended for all agricultural producers and consumers who buy or sell products from the categories of livestock farming, plant production, mechanization and food products; and *BOCCUN* - an innovative digital platform that connects winemakers and wine lovers, facilitating the experience of researching, selecting and purchasing wine with one click.

Although not primarily focused on agriculture as a sector, Tehnopolis remains one of the key drivers for innovations and digitalization of businesses in this sector in Montenegro, mainly through regular business and startup development and support services, as well as through regional and EU partnerships that are unlocking new knowledges and technologies through research and development. As a centre for innovation and entrepreneurship, they are one of the most sought-out collaborators to other similar organizations in the Western Balkans.

3.5. ITP PRIZREN - KOSOVO

Full name	**Innovation and Training Park (ITP) Prizren**
Type of organization	Association
Active since	2020
Reach	National
Founders	Governments of Kosovo and Germany
Website	https://itp-prizren.com/

The Innovation and Training Park (ITP) Prizren is a dynamic hub in Kosovo dedicated to fostering innovation, business development, and skills enhancement across various sectors, including agriculture. In its conceptualization, agriculture was intended to be one of key areas of activity, however, today ITP Prizren focuses primarily on Information and Communications Technology (ICT), creative industries, green and environmental technologies, research and development, and vocational education.

Their contribution to the advancement of agriculture in the country and beyond is done by:

- Promoting innovation;
- Facilitating digital transformation; and
- Providing essential training and resources to stakeholders in the agricultural sector.

Established and co-financed by German and Kosovo Governments, and based in former military camp, ITP Prizren manages an excellent infrastructure spread on 40 hectares of green spaces and nearly 50 buildings, now home to Kosovar, regional & international companies, universities, research & education institutes/foundations and VET Providers, public institutions and agencies, and civil society organizations. Both infrastructure and tenants are mobilized to provide the following key services: digital ecosystem development, office and co-working spaces for businesses and startups, businesses and startup support services, accommodation and recreational facilities for students and networking events to foster cooperation and knowledge management. ITP Prizren is also a lead organization in the recently established European Digital Innovation Hub (EDIH) DIG 4-K, aimed at accelerating Kosovo's digital transformation and positioning the country as a regional hub for digital innovation, skills development, and entrepreneurship. Agriculture is positioned to play as one of key sectors targeted by EDIH.

Contribution to innovation development in agriculture

ITP Prizren does not have services or own units that work directly on innovations, however, the platform is **host** to several organizations coming from public, private and academic background that are focused on innovation development. **Kosovo Research and Education Network (KREN)** is a tenant from the very opening of ITP Prizren. Operating under the Ministry of Economy of Kosovo, KREN is building a shared, purpose-built communication infrastructure exclusively for educational institutions. This network ensures that schools, universities, and research centers have access to a secure, high-quality platform that not only meets their current needs but is also capable of evolving with future technological demands. All formal education providers in Kosovo are part of KREN, while most universities act as direct partners for the network. KREN also hosts **Digital Excellence Center (DEC)** in ITP Prizren, which is a test environment (laboratory), and at the same time as a space for education and research of regional development. DEC is established by Ministry of Economic Development of Kosovo and is focused on study, research and development of latest ICT and electronic communications trends such as 3D printing, 5G, IoT and blockchain. Neither KREN nor DEC deal specifically with agriculture, however, they can be in service of the sector. ITP Prizren is also home to three different universities. **University "Ukshin Hoti" Prizren**, which has study programs focused on agribusiness and environment, has established a **Center for Research, Innovation and Knowledge Transfer** at ITP Prizren with the aim of performing scientific research and applied work, in accordance with the needs of the University, businesses, industry, governmental community, as well as other stakeholders. Private **University for Business and Technology – UBT** has one of its campuses within ITP Prizren, and among offered study programs there is a one on food science and biotechnology. UBT puts great emphasis on research and has set up more than 40 research laboratories in its network while offering more than 200 research grants

and several other national and international scholarships to its students. **University of Konstanz** (Germany) has established a **Kosovo Environmental Education and Research Center** at ITP Prizren, a field station focused on ecology and equipped with relevant equipment and demonstration material. Finally, companies hosted by ITP Prizren also contribute to innovation. **Toka Green** is a company focused on developing fully autonomous Aeroponic Farming Systems. Their aim is to create the most efficient way of farming with less water, less space, and shorter growth time from seed to harvest.

Contribution to technology and knowledge transfer in agriculture

While many training programs at ITP Prizren focus on ICT and creative skills, the park, through its tenants, especial academia, also offers **vocational education and training** that can benefit the agricultural sector. These programs aim to equip individuals with the necessary skills to implement modern, technology-driven agricultural practices. Center for Research, Innovation and Knowledge Transfer of University "Ukshin Hoti" Prizren offers annual training catalogue and has addressed topics such as environmental protection, livestock production and dairy and use of GIS. They also tackle agricultural and food policies with their Prizren International Summer School, organized for the first time in 2022. In the field of ecology, University of Konstanz thought their Kosovo Environmental Education and Research Center is organizing different **field trips, summer schools, training sessions, courses and expert meetings**. Outside of agricultural topics, ITP Prizren is home to many different advanced technology trainings and sessions through tenants like: Makerspace – Innovation Center Prizren, Cacttus Education and University for Business and Technology – UBT.

Contribution to business and startup development and support

ITP Prizren's strongest assessed contribution is to business and startup development and support. They are actively seeking to attract and support businesses, startups and other organizations, including those within the agro and food processing industry. By providing infrastructure, advanced digital services, and networking opportunities, ITP Prizren aims to enhance innovation and efficiency in agricultural practices and food production. One of key support services is their **Digital Transformation Center (DTC)**. DTC offers digitalization support to various sectors, including agriculture. Through this center, agricultural enterprises can access services that assist in integrating digital technologies into their operations, thereby improving productivity and market competitiveness. DTC is also functioning as a Digital Innovation Hub, and gathers a strong consortium of all tenants mentioned in the previous two sections, and many more. DTC was also key instrument in a project Digital4Business (German Government, EU) which was focused on supporting Micro and Small Enterprises (MSEs) to increase their resilience and agility through the process of digitalization and digital transformation, through science, education and technology for businesses. One more relevant activity of the project was Digital Skill Festival under which a dedicated hackathons and workshops were organized for students on the topic of green and sustainable businesses as well as IoT Smart Agriculture. ITP Prizren manages 44.000 sqm of **rentable space for businesses** while 750 sqm is reserved for startups. This space is available to agribusinesses as well, while some of them are tenants from the very opening of the park.

Impressive incentives of ITP Prizren for boosting the innovative ecosystem in Kosovo are yet to be enlarged with EDIH initiative Digital Innovation Gateway for Kosovo (DIG-4K), aimed at accelerating Kosovo's digital transformation and positioning the country as a regional hub for digital innovation, skills development, and entrepreneurship. Agriculture, as one of the sectors of key interest to DIG-4K will this benefit from advanced entrepreneurship and innovation-driven

services, as well as support to adoption of advanced digital technologies among farmers and agribusinesses.

3.6. AGRICULTURAL TECHNOLOGY TRANSFER CENTERS – ATTCS – ALBANIA

Full name	**Agricultural Technology Transfer Centers (ATTCs)**
Type of organization	Public R&D units under ministry
Active since	2006
Reach	Regional
Founders	Government of ALB
Website	https://www.bujqesia.gov.al/qendrat-e-transferimit-te-teknologjive-bujqesore-qttb/

The Agricultural Technology Transfer Centers (ATTCs) in Albania are 5 public institutions operating under the structure of domestic Ministry of Agriculture and Rural Development. Located in Fushë Krujë, Vlora, Shkodra, Korça and Lushnja, they serve as regional hubs for applied agricultural research, demonstration, training, and knowledge dissemination. The ATTCs aim to enhance agricultural productivity, promote the use of certified inputs, and facilitate the adoption of sustainable agricultural practices by farmers and agribusinesses. All centers are focused on different types of crops, however some of them also deal with livestock (FushëKruja and Korça) and medicinal and aromatic plants (Shkodra). Although all centers share similar main tasks, their activities differ based on internal capacities.

Activities	Fushë Krujë	Korça	Shkodra	Vlora	Lushnja
Improvements of products, services and processes		•		•	•
Laboratory services	•	•	•		•
Consulting and expertise	•	•	•	•	•
Information on standards and patents		•			
Technology transfer	•	•	•	•	
Technology testing	•	•		•	•
Database usage	•	•		•	
Joint participation in EU funded projects		•		•	

As publicly founded and owned organizations, these centers are mostly funded by state budget, however some of them also have own income through conducted activities (Shkodra, Korça and Lushnja) or though EU funded projects (Korça and Vlora).

Contribution to innovation development in agriculture

ATTCs play a central role in promoting agricultural innovation in Albania through **applied research and testing** of new crop varieties, pest management techniques, and sustainable production models. ATTC Lushnje has conducted multi-year testing of hundreds of wheat, maize, and vegetable seed varieties, selecting those that demonstrate superior resistance to diseases and climate variability. These varieties are further developed and certified for commercial use. ATTC Vlora contributes to innovation in the cultivation of high-value and perennial crops by **experimenting** with planting techniques, irrigation methods, pruning systems, and soil management practices. Its work on sustainable olive and citrus production, including **trials** of biological pest control methods, has helped introduce environmentally friendly solutions into mainstream farming practices. Innovation is often driven by field-level feedback, as farmers' challenges are used as the basis for adaptive research and new technological packages. Unlike mentioned centers, ATTC Korça is also conducting research related to livestock production and creating new breed nucleuses aimed at meat production.

Contribution to technology and knowledge transfer in agriculture

The ATTCs serve as key platforms for the dissemination of agricultural knowledge and technologies. They regularly organize **on-site demonstrations**, **field days**, and **training sessions** aimed at farmers, agronomists, and local extension workers. QTTB Vlora for example has developed **technological packages and model projects** for orchard establishment and management, which are shared through **training materials**, **in-person coaching**, and **collaboration with regional extension services**. **Demonstration plots** located on center premises are used to show best practices in pruning, fertilization, irrigation, and pest control. Knowledge is transferred through direct training and also through collaboration with universities, research institutes, and international partners, including participation in EU-funded research and innovation projects.

Contribution to business and startup development and support

Although not operating as a traditional business or startup service provider, ATTCs are contributing significantly to the development of farmers and small agricultural businesses by offering **practical support in production planning**, access to **quality inputs**, and market-oriented **technical assistance**. ATTC Lushnje has built a reputation for its work in producing and distributing certified seeds, ensuring that high-quality and disease-resistant varieties reach farmers and thus contribute directly to the competitiveness of local farms and agri-enterprises. The training programs, technical assistance and technological packages offered by ATTC Vlora are essential in supporting for example young farmers and entrepreneurs looking to establish modern orchards or diversify into high-value crops. By improving technical know-how and reducing the risk of crop failure through **certified materials** and proven practices, the centers indirectly support the establishment and scaling of rural enterprises. In addition, their collaboration with extensions services, farmer associations, cooperatives, and donor-funded initiatives strengthens the broader agri-business ecosystem in the regions they serve.

Through applied research, certified input provision, and extensive education and work with farmers, the ATTCs significantly contribute to the innovation, knowledge transfer, and modernization of Albanian agriculture. Their model demonstrates the value of public agricultural research and extension infrastructure in addressing local needs while aligning with broader development goals.

4. COMPARATIVE ANALYSIS

While the assessed platforms operate in different national and regional contexts, several patterns and distinctions can be observed that provide insight into potential success factors and opportunities for replication or improvement. In order to extract insights, a comparison of all six innovation platforms is made focusing on their organizational characteristics, operational models, and specific contributions to innovation development, technology and knowledge transfer, and business/startup support in the agricultural sector.

A direct comparison of organizational profiles of all six platforms is shown in the following table:

Feature	Smart Village Knežica (BiH)	PA4ALL (SRB)	CDA/AgFutura Technologies (NMK)	Tehnopolis (MNE)	ITP Prizren (XK)	ATTCs (ALB)
Type of organization	Cooperative (operating as NGO)	Unit of public R&D institute	Private enterprise	Public enterprise	Association	Public R&D unites under ministry
Founders	Private individuals	Public R&D institute/ Government of Serbia	Private individuals	Government of Montenegro	Governments of Kosovo and Germany	Government of Albania
Operational level	Local	International	National / regional	National and regional	National and regional	Regional (5 centers)
WB innovation partnerships	Yes	Yes	Yes	Yes	Yes	Yes
Funding model	Bilateral and EU projects	Public funding and EU projects	Commercial services, service contracts, EU projects	Public funding, EU projects, services	Public funding, EU projects and tenants	Public funding, EU funds and services
Scalability	Moderate – replicable in similar regions	High – modular, tech-driven	High – adaptable services, tech-driven	Moderate – depends on regional / national strategies	High – multi-sectoral and modular	Moderate – region-specific, public-owned
Sustainability	Linked to project cycles, exploring diversification	Strong due to diversified income streams	Strong due to commercial orientation	Moderate – dependent on projects and state funding	Dependent on continued public/ private interest	Moderate – dependent on state funding and services
Business model	Support services and project-based innovation	R&D, tech transfer, product development	B2B and consulting	Space rental and lab services	PPP facilitation and space rental	Public R&D services, input production, trainings
Role in curriculum and VET reforms	Active	Active	Active	Active	Indirect	Active

This direct comparison of the observed platforms leads to several conclusions:

- Platforms operate under different organizational structures, ranging from cooperative and association to public enterprise, private company, and government units. This diversity reflects adaptation to context-specific needs, resource availability, and governance systems in each country.

- Platforms initiated by private individuals (CDA/AgFutura Technologies, Smart Village Knežica) tend to be more agile and market-oriented, while those established by governments (ATTCs) are more aligned with public development agendas and policy goals.

- Most platforms operate at national and regional levels, enabling broader outreach and systemic influence. Only one (Smart Village Knežica) is primarily local, while PA4ALL reaches international stakeholders, showing scalability potential for digital and tech-focused platforms.

- All platforms are engaged in Western Balkans regional innovation partnerships, mostly through various regional and trans-national project-driven activities. Although these six specific platforms do not have many joint cooperation activities (with exception between Smart Village Knežica and PA4ALL), they all frequently appear together in awareness-raising and showcasing activities (conferences, seminars and similar) as leading advocates for innovation-driven agricultural development.

- All platforms rely on a combination of funding sources, typically including public funding and EU projects. However, platforms like CDA/AgFutura Technologies and ATTCs also generate income through commercial services or product development, increasing their financial resilience.

- Tech-driven and modular platforms (PA4ALL, CDA/AgFutura Technologies) show higher scalability potential, particularly in digitalization and innovation services. Others are more region-specific or reliant on public infrastructure, limiting replication across different contexts.

- Sustainability is a challenge for platforms heavily reliant on public or donor funding (Smart Village Knežica). In contrast, CDA/AgFutura Technologies demonstrates stronger sustainability due to commercial revenue streams and diversified funding strategies.

- Business models align with institutional mandates of platforms. Private actors like CDA/AgFutura focus on B2B services and consulting. Public platforms like ATTCs and PA4ALL offer R&D services, trainings and product development. Lastly, hybrid models like ITP Prizren and Tehnopolis combine public-private partnerships with ecosystem facilitation.

- The role of these platforms in curriculum and VET development is mostly active and rather diverse. Smart Village Knežica and Tehnopolis work with local elementary and high schools, by either developing specialized trainings for use of digital tools and advanced technologies (e.g. mechatronics, robotics, IoT). PA4ALL is actively shaping high school curriculum in Serbia on precision agriculture and is a research ground for many academic papers. CDA/AgFutura Technologies has cooperation with various faculties and together with them is setting up experimental sites used by students for their education and research. ATTCs in Albania actively work with domestic faculties by sharing their resources and providing practice for students. The role of ITP Prizren is different in comparison to other platforms since they do not work directly in this area but are home to several universities offering relevant education.

A summary of key similarities and differences among observed platforms in terms of focus, structure, reach, sustainability and client engagements shows the following:

Criteria	Key Similarities	Key Differences
Focus	All platforms foster innovation, R&D and support agri-sector transformation	Some platforms focus more on high-tech innovation (PA4ALL, CDA/AgFutura Technologies), others on grassroots or public extension (ATTCs, Smart Village Knežica)
Structure	Most platforms strive towards digital innovation hub concept	Type of organization varies from private companies to public R&D to non-profit-led platforms
Reach	Almost all platforms operate at least regionally	PA4ALL, CDA/AgFutura Technologies have stronger national/EU engagement
Sustainability	All platforms are working to diversify funding	Private or tech-oriented models (PA4ALL, CDA/AgFutura Technologies) show stronger market viability
Client engagement	All platforms support farmers or agribusinesses	Levels of direct startup support vary significantly

All the six platforms contribute to innovation development, but with differing levels of technological sophistication and institutional orientation. Their focus ranges from smart farming and food tech, to climate-resilient practices. Overall, platforms with embedded R&D capacity tend to have a deeper and more sustained role in agricultural innovation. Below is an overview of how the observed platforms contribute to innovation development, and their respective level of sophistication.

Contribution to innovation development	Smart Village Knežica (BiH)	PA4ALL (SRB)	CDA/AgFutura Technologies (NMK)	Tehnopolis (MNE)	ITP Prizren (XK)	ATTCs (ALB)
How	Experimental fields, prototypes R&D projects	Real-world and real-time testing of ideas and prototypes, R&D projects	Developing, testing, and evaluating technological solutions, R&D projects	Prototypes, pilot labs, hackathons, R&D projects	Indirectly, through hosted R&D organizations	Applied research, testing and experimenting
Sophistication	Grassroots innovation through co-creation with farmers, offering applied solutions tailored locale	Cutting-edge research and digital innovation (IoT, sensors, AI), including the development of proprietary platforms for precision agriculture	Data-driven innovation and advanced digital tools employed for development of agri-tech solutions for and in cooperation with commercial clients and public projects/ organizations.	Provide R&D infrastructure such as laboratories for developing prototypes or testing innovations	Provides a multi-sectoral space for innovation and entrepreneurship, and support innovation through partner organizations	Highly practical and field-specific applied research, varietal testing, and adaptation of sustainable farming practices

All platforms prioritize technology and knowledge transfer, but their methods and target groups vary. A common thread is the emphasis on training, workshops and demonstration, although the depth of reach (e.g., to smallholders vs commercial farms vs agri-professionals) and the type of knowledge (scientific, technical, digital) vary significantly. Below is an overview of identified approached to technology and knowledge transfer among observed platforms.

Contribution to technology and knowledge transfer					
Smart Village Knežica (BiH)	**PA4ALL (SRB)**	**CDA/AgFutura Technologies (NMK)**	**Tehnopolis (MNE)**	**ITP Prizren (XK)**	**ATTCs (ALB)**
• Educational courses and trainings, • Awareness-raising and knowledge exchange sessions, • Informational web platform	• Design and testing of new technologies, • Development of educational materials and free online services, • Workshops, fairs, trainings and other events, • Educational reforms, • Contribution to domestic and EU policies • Building of cooperation networks.	• Standard and specialized educational programs, • Workshops and conferences, • Demonstrations • Research papers	• Conferences and workshops, • Expos • Publications.	• Vocational education and training, • Field trips, summer schools, training sessions, courses • Expert meetings	• On-site demonstrations and field days, • Training sessions, • Technological packages and model projects, • Collaboration with regional extension services, • Demonstration plots

Finally, business development support among observed platforms varies based on institutional missions and resource availability. All platforms offer services to farmers and agribusinesses, while only some of them offer direct startup services (incubation, mentoring, matchmaking). The most robust impact is observed in platforms that integrate both elements.

Contribution to innovation development	Smart Village Knežica (BiH)	PA4ALL (SRB)	CDA/AgFutura Technologies (NMK)	Tehnopolis (MNE)	ITP Prizren (XK)	ATTCs (ALB)
How	Advanced technology services, e-business services and support to youth, youth-led farms and agri-business startups.	End-user approach to testing, synergies with agribusiness companies and startups, synergies with agri-business support companies, and involvement of ICT sector.	Commercial services and projects in partnership with international organizations	Supporting farmers and agribusinesses with commercial and subsidized services, and startups through Business incubator, TechLab, Data Center, pre-accelerator and accelerator programs, startups camps, and various pitching competitions	Digital Transformation Center (DTC), and rentable space for businesses and startups.	Practical support and technical assistance in production planning, provision of quality inputs such as certified planting material, and market-oriented technical assistance.

5. CONCLUSIONS AND RECOMMENDATIONS

The comparative analysis of the six observed platforms reveals that effective innovation platforms typically share several core traits:

- adaptability to local, regional and national contexts and needs,
- multistakeholder engagement (government, academia, private sector and civil society), and
- a blend of direct and indirect business support activities.

The analysis also suggests that:

- Hybrid models that combine public infrastructure with market-oriented services and applied research are best positioned to deliver sustainable and scalable impact.
- Platforms like ATTCs in Albania, Smart Village Knežica in Bosnia and Herzegovina and CDA/AgFutura Technologies from North Macedonia play a significant role in inclusive outreach and rural development, especially for smallholders and underserved communities.
- Tech-driven platforms such as PA4ALL from Serbia and CDA/AgFutura Technologies from North Macedonia are frontrunners in innovation and commercialization.
- Multi-sectoral innovation hubs like ITP Prizren from Kosovo and Tehnopolis from Montenegro illustrate the value of broader innovation ecosystems that support and promote agri-tech alongside other industries, but also give incentives to startup and entrepreneurship development.
- Sustainability is most achievable where platforms diversify income streams, stay responsive to stakeholder needs, and maintain institutional flexibility.

These suggestions propose that in an ideal case scenario, the **most effective platform** for supporting agricultural innovation and transformation in the Western Balkans would be based on a **hybrid model**, integrating **public infrastructure** with **market-driven services** and **applied R&D,** maintains a **diversified revenue** (service provision, public funds, donor projects), and proactively **responds to local needs** by bridging the gap between research, practice and policymaking.

The Western Balkans is already home to a diverse range of innovation-driven organizations and platforms, as highlighted in this analysis and confirmed through the SMARTLABOUR project's regional stakeholder mapping. Therefore, the way forward does not necessarily require the creation of entirely new platforms, following the proposed ideal case scenario above. Instead, existing structures should be strengthened, reoriented, and better connected.

Traditional research platforms need to rethink and modernize their operations to remain relevant and impactful. More advanced or specialized platforms should consolidate efforts and build strategic cooperation based on their unique strengths. Regional cooperation models should be leveraged to extend reach, pool resources, and avoid duplication. Ideally, this process can be supported and structured through broader innovation concepts such as (European) Digital Innovation Hubs, tackled already by most of the analyzed platforms.

While scaling and replication depend on funding, institutional capacity, and policy support, the platforms studied in this report demonstrate that strategic investment in such initiatives can significantly accelerate and contribute to the transformation of agri-food systems in the Western Balkans. When combined with regional cooperation, these platforms can build upon each other and serve as key enablers for boosting innovation, productivity, and sustainability in agriculture.

As a final though, the presented cases teach us that the specific form or structure of an innovation platform is less important than the mindset and background behind it. What truly drives meaningful innovation are the people and communities who approach challenges with motivation, openness, and a willingness to experiment. When progressive thinking is rooted in real needs and opportunities, and when the broader environment enables rather than restricts innovation, impactful transformation becomes possible, regardless of whether the platform is public, private, formal, or informal. It is this combination of human drive, contextual responsiveness, and supportive ecosystems that makes innovation platforms succeed.

Norway
SMART Balkans
Civil Society for Shared Society in the Western Balkans
CPCD
Center za promociju civilnog društva
Institute for Democracy and Mediation
CRPM
Center for Research and Policy Making
... policy impact since 2004
CENTAR
PUBLIC POLICY RESEARCH
re:people
CREDI
Centar za razvoje evaluacije i društvena istraživanja
IMPETUS
CIDGG