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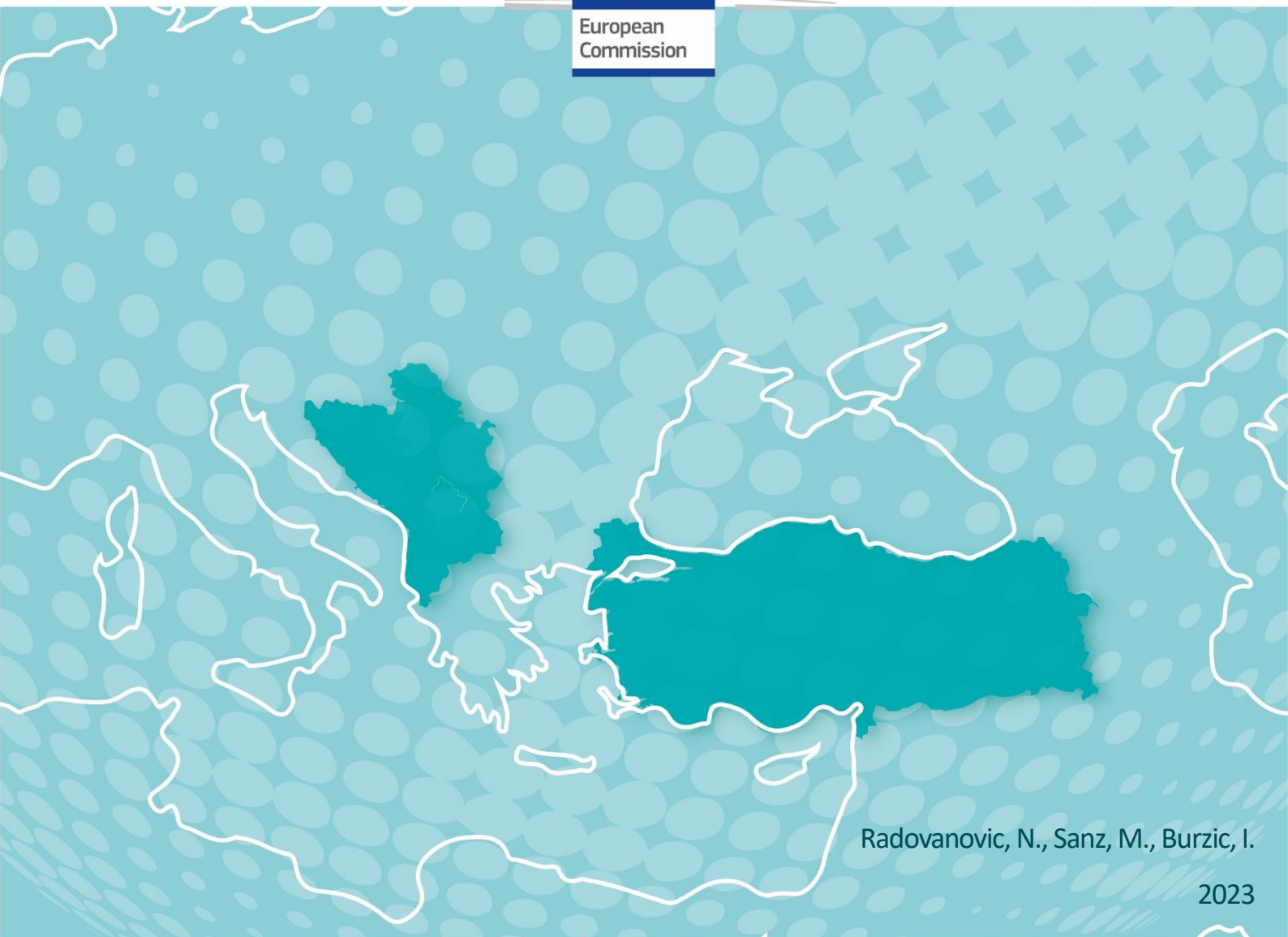
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Perspectives on growth of the agri-food sector in the Western Balkans



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Contents

Abstract.....	1
Executive summary	2
1 Introduction.....	3
2 Methodology	4
3 Status quo in the agri-food area in the Western Balkan economies.....	5
3.1 Analysis of the economic impact of the agri-food sector in the Western Balkans economies.....	6
3.2 Scientific, research and innovation performance of the agri-food sector in the Western Balkans.....	8
3.2.1.1 Patent activity	8
3.2.1.2 Scientific publication activity in the Western Balkan economies.....	9
3.2.1.3 R&D cooperation projects involving the Western Balkans	11
3.2.1.4 Funding opportunities for innovation	12
4 Challenges and opportunities for collaboration in the agri-food area in the Western Balkan economies.....	22
4.1 Production of high value products.....	22
4.2 Digitalisation of the agri-food value chain	23
5 Results of the survey	24
6 SWOT analysis	32
7 Conclusions and recommendations	35
7.1 Increasing the capacities for innovation and technological development	35
7.2 Strengthening human resources in the field of research and innovation	36
7.3 Increasing productivity by modernisation and digitalisation.....	36
7.4 Enhancing the integration of local agri-food value chains into global value chains	37
References	38
List of abbreviations and definitions.....	39
List of figures.....	40
List of tables.....	41

Abstract

Smart Specialisation in the Western Balkans revealed that agri-food features as one of the most common priority areas in the region with the strongest potential for growth. Although the Smart Specialisation process revealed many strengths, the agri-food sector in the Western Balkans is still facing some common challenges, including lower levels of productivity and product diversification. On the other hand, agri-food stakeholders from the Western Balkan region have the potential to increase the sector's capacities for innovation and technological development, and redesign agri-food value chains to make these more efficient, competitive, resilient and environmentally friendly. The business sector is a key driver in the structural transformation of agriculture, but the role of the public sector and academia in this process is equally important. Structural transformation of the agri-food sector should stimulate the production of high value products, and enable modernisation and digitalisation, to increase productivity and encourage cross-sectoral synergies and cooperation at the regional level.

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Executive summary

After six years of the implementation of the Smart Specialisation approach in the EU Enlargement and Neighbourhood Region, this exercise revealed the first common priority areas in the Western Balkans. Among these, the agri-food priority domain was identified as one of the most important economic and innovation drivers of the sustainable competitiveness in the Western Balkan region. The economies of the region engaged a wide array of stakeholders to discuss the findings from the analysis of economic, innovation and scientific potential of the agri-food area and open the dialogue on the policy mix for this area. The mentioned analysis and dialogue revealed many similarities about the strengths and challenges within the region, which were further discussed during the first thematic Smart Specialisation workshop on the agri-food priority domain organised by the Joint Research Centre in 2021. The findings from the analyses and the thematic workshop served as a basis for conducting a study on the R&I strengths and regional potential for inter- and intra-regional collaboration in the agri-food domain.

The implementation of agri-food targeted actions in the Smart Specialisation exercise requires more attention, stronger focus and coherence with overarching goals of sustainable national and regional development. With that in mind, it is recommended to (re-)shape policy measures and actions that will gather all involved parties in different types of fora and events to discuss the Smart Specialisation in the agri-food area and share experiences and ideas. Such policy measures and actions should exploit the research and innovation potential and build on the collaboration possibilities between the regional stakeholders. This study took into account various findings concerning the economic, research and innovation performance of the entire Western Balkan region in the agri-food domain and discussed many of them with the key stakeholders from the region within a targeted survey.

The findings of the study point to several actions that should support the transformational perspective of the agri-food domain in the Western Balkan region, aiming at upgrading the regional agri-food value chain for higher value and better integration options. These actions are grouped into the measures focused on increasing the capacities for innovation and technological development, strengthening R&I resources, increasing productivity by modernisation and digitalisation, and enhancing the integration of local agri-food value chains into global value chains.

The Western Balkan's potential in the agri-food area is vast and has a fertile ground for sustainable growth and strong development perspective. Its research and innovation strengths have been revealed within the Smart Specialisation exercise and discussed among the key stakeholders. The national authorities would need to further build on the proposed actions for the development of this sector and collaboration with other economies in the region in order to utilise its enormous possibilities in the global arena.

1 Introduction

Following the success in implementing the Smart Specialisation approach in the European Union, the Smart Specialisation exercise was launched in Serbia, Ukraine and Moldova, as the first countries from the EU Enlargement and Neighbourhood Region, in 2016. By 2018, all Western Balkan economies had embarked on the Smart Specialisation journey. Up to 2023, all of them had identified the final or preliminary priority areas of their respective Smart Specialisation processes. The identification was completed in an evidence-based manner by following the Smart Specialisation framework for the EU Enlargement and Neighbourhood Region. The framework sets the conditions for completing the Smart Specialisation process in a way that is transparent and participatory. The exercise revealed the agri-food domain to be one of the common priority areas.

The agri-food sector represents a significant segment of the regional economic and social structure, and it plays an important role in the stability of Western Balkan economies. Although its importance for national economies in the region was evident, agri-food had failed to reach its full potential.

The successful transformation of agriculture has the potential to unleash economic growth, create jobs, raise income and improve the livelihoods of people in rural areas (Lin et al, 2021; Gollin, 2010; Huffman and Orazem, 2007; Timmer, 2002). To achieve these objectives, Western Balkan economies must increase productivity and competitiveness of the agricultural sector and improve the conditions for farmers to thrive. Participation of farmers in the value chains in the Western Balkans could be improved by targeted advisory services, better access to finance and support for partnerships and investments (Djordjevic Milosevic et al, 2021). The general strategy for the agri-food value chain should be to focus on providing high value products in a sustainable way, considering economic, health and environmental perspectives above all. Tackling common challenges faced by agri-food stakeholders in the region, based on analysis from the Smart Specialisation processes, can provide a solid foundation for enhancing stakeholder collaboration beyond national boundaries in pursuit of joint interests. Economies in the Western Balkans have the potential to redesign agri-food value chains to boost such transformation by applying an array of collaborative policy measures in the research and innovation domain.

This paper presents the potential for research and innovation in different areas in the agri-food sector in the regions of the Western Balkan economies. It identifies promising niches for cooperation in agri-food. It takes into account the work done in analysing economic, innovation and scientific potential of the agri-food sector. It elaborates on the results of the survey, targeting key stakeholders in the agri-food field, and provides conclusions and recommendations for the implementation of policies, measures and programmes related to innovation that can improve the competitiveness of the agri-food sector.

2 Methodology

This document provides analysis of the regional research and innovation capacities and promising cooperation niches in the agri-food area in the Western Balkan economies. The methodology included desk research and a qualitative survey. The first step included the analysis of available data concerning the value chains and the economic, innovation and scientific potential of the agri-food area based on the Smart Specialisation exercise. It also included the research and innovation capacities of the Western Balkan economies regarding the agri-food area and sub-areas as identified in the Smart Specialisation processes. The analysis took into account the findings from the first thematic Smart Specialisation workshop, which tackled agri-food as a common priority area, held in 2021 (Radovanovic et al, 2022). Based on the findings from the analysis, a questionnaire was developed for a survey with key stakeholders from the agri-food area in the Western Balkan economies. The final step was to derive conclusions and recommendations for future steps by focusing on research and innovation capacities and collaboration potential in the agri-food area in the Western Balkan region. The work has taken also in account the Smart Specialisation methodology as given in the Smart Specialisation framework for the EU Enlargement and Neighbourhood Region, as well as in the Smart Specialisation implementation framework for the EU Enlargement and Neighbourhood Region¹.

The sections of the report include the following:

- Status quo in the agri-food area (the objective of this section is to present a snapshot information on the value chains in the agri-food area in the region and present key specificities related to each economy's economic, innovation and scientific performance).
- Challenges and opportunities for collaboration (the objective of this section is to elaborate on the opportunities for collaboration in the agri-food area taking into account its sub-domains and current trends).
- Results of the survey (the objective of this section is to elaborate on the feedback of the stakeholders that took part in the survey explained below).
- SWOT analysis (the objective of this section is to highlight key strengths and weaknesses of the agri-food sector in the Western Balkans considering the external effects).

Data sources used for the analysis include various literature, such as the 'Analysis of the Western Balkan value chains report', Smart Specialisation country reports and related publications, report from the first thematic Western Balkans workshop on agri-food², as well as the results of the stakeholder analysis carried out for the purpose of this study. The online survey was developed in consideration of the results and conclusions from the analysis. The questionnaire was composed of a list of questions distributed into three different sections:

- About the organization: basic information about the organization, type of entity, size of the business.
- About the sector: in this section, information was requested concerning the stage of the agri-food value chain the entity is operating within. In addition, questions related to the barriers and opportunities presented by the agri-food sector in the Western Balkan economies were included in this section.
- About research and innovation potential of business sector and research centres: in this section, companies were asked about their experience in R&D and innovation activities (introduction of technological innovations, acquisition of patents), and any previous experience in collaborative R&D environments with other sectors, other types of entities (with research organizations, other companies...) and other regions of the Western Balkan economies and Europe.

Specific objectives were set in terms of expected responses. These included:

- at least 15 key respondents per each Western Balkan economy,
- at least 50% of respondents to the survey must belong to the business sector and the rest of it should come from academia, civil organisations and the public sector.

¹ For more information about both S3 design and implementation frameworks, please see related sections at the JRC Knowledge Hub, available at <https://s3platform.jrc.ec.europa.eu/knowledge-hub>

² Please find relevant publications at <https://s3platform.jrc.ec.europa.eu/knowledge-hub>

3 Status quo in the agri-food area in the Western Balkan economies

The agri-food sector is a significant segment of the economic and social structure and plays an important role in the stability of the overall economic flows in the Western Balkan economies. The abundance of natural resources and favourable climatic conditions make agri-food one of the region's oldest and most reliable economic sectors. The successful transformation of agriculture has the potential to unleash on- and off-farm economic growth, create jobs, raise income and improve the livelihoods of people in rural areas throughout the Western Balkan economies (World Bank, 2018). To achieve this, Western Balkan economies need to improve productivity and increase the competitiveness of the agricultural sector.

While the climate in the Western Balkan economies is well-suited for agriculture, droughts combined with high temperatures are a hazard for agricultural production. Floods and hail have a localized impact on agriculture in the region. Water for irrigation is either free or very cheap, but the cost of irrigation is nevertheless high, due to the consumption of gasoline. Commercial producers usually irrigate fruit and vegetable plantations, but producers of field crops face financial constraints to make the required investments in irrigation. Agricultural insurance remains underdeveloped, regardless of various efforts to improve the situation (World Bank, 2018).

Bosnia and Herzegovina and North Macedonia have the greatest potential in the production of bakery and farinaceous goods. In addition to the production of these products, Serbia has potential in the processing and preserving of fruit and vegetables, the processing and preserving of meat, and the production of meat products. Montenegro and Albania lack the capacity to be impactful actors in the processing industry, but they do have significant potential in the production of seasonal fruits, vines and olives as well as in livestock.

The private sector is a key driver of structural transformation of agriculture, but the public sector could have an important role in the process as well. The Western Balkan economies hold a significant share of the production of vegetables compared to the EU, but production is not large enough to drive global markets. The share of the agri-food sector in the total value added varies between 25% in Albania and slightly above 10% in Montenegro and Bosnia and Herzegovina. In most economies, these shares have been on a declining trend since 2012, with the exception of Albania (Matusiak et al., 2022). The Western Balkan economies are not well integrated into Europe's vibrant GVCs. Trade within the region is also limited as it tends to be bilateral and not cluster-like (IMF, 2019). Trade structures are dominated by crop and animal production in Albania, North Macedonia and Serbia, and by manufacture of food products in Albania, Bosnia and Herzegovina, North Macedonia, Montenegro, Serbia and Kosovo*. Montenegro and Kosovo also show a relatively high share of exports of tobacco products. Exports have been rising strongly in Albania, Serbia and Kosovo. Within the food products industry, the manufacture of bakery and farinaceous products is particularly important in Bosnia and Herzegovina and North Macedonia, whereas the structure in Serbia is more differentiated. Each worker employed within the sector generates EUR 76 000 per year, making these companies highly productive. Each asset worth EUR 1 generates 55 cents worth of operating revenues per year, which is again around the mean for all the sectors.

Public spending in agriculture displays significant variations and is not correlated with output growth across the Western Balkan economies. Between 2010 and 2015, total budgetary transfers to agriculture as a proportion of GDP was just 0.26 % in Albania, 0.49 % in Montenegro and Kosovo, 0.51 % in Bosnia and Herzegovina, 0.72 % in Serbia and 1.14 % in North Macedonia (Matusiak et al., 2022). Many of the agri-food products exported are non-GMO or even organically produced but they are not branded and promoted as such. Luxury and expensive products account for a small proportion of total exports. A major share of these export products goes to the Western Balkan economies themselves and the EU market, while a very small share is exported to other regions across the world, such as, for example, Russia in case of Serbian exports. Bosnia and Herzegovina has the largest values of exports of agricultural and food products to the Western Balkan economies, while the EU countries present the second most important market for exporting agricultural and food products.³

Regarding the number of employees, small businesses mainly perform the activities within the second (production) and third (collection) levels of the value chain. The needs of processing companies significantly determine the direction of development of small producers. Processing companies are domestic private companies or foreign companies, if holding more than 50% of the capital. On the other hand, actors in the lower levels of the value chain (input supply, production and collection) are mostly domestic private companies. Agricultural and food products are among the most important components of trade for the economies of the

* This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence.

³ Strategic Plan for Rural Development of Bosnia and Herzegovina (2018-2021), Framework Document.

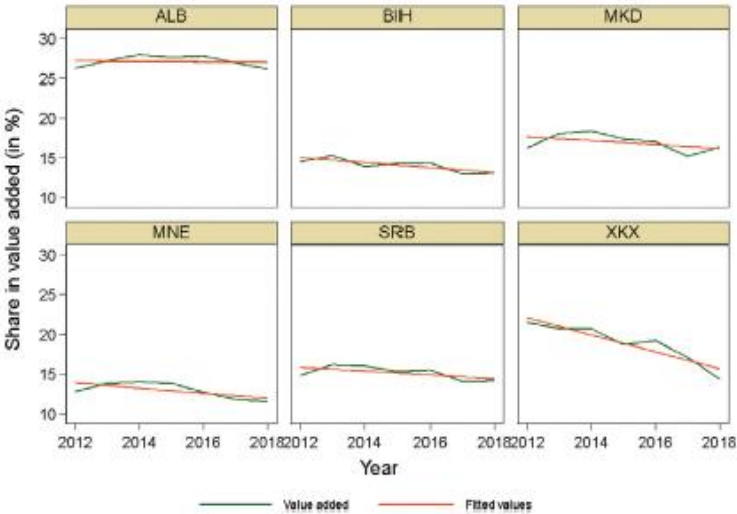
Western Balkan economies. Low value-added products, which account for a negligible share of international trade, form the basis of the Western Balkan economies foreign trade. Most processing companies are export-oriented and they export between 10% and 78% of their total production. In most cases the inputs are obtained from the country in which the processing companies' headquarters are located, mainly because that country generally has enough input. If imports are necessary, processing companies tend to restrict themselves to raw materials such as various packaging, labels, cork, etc., which account for 5-10% of total inputs. These raw materials are not necessarily procured from the Western Balkan economies but also from EU Member States. It is the case only when the parent company has its headquarters in one of the EU Member States that processing companies import part of their inputs from other Western Balkan economies.

3.1 Analysis of the economic impact of the agri-food sector in the Western Balkans economies

Investments and R&D activities are a valuable indicator of economic progress. There is a direct correlation between the European Innovation Scoreboard (EIS) of EU-27 and GDP per capita, as the countries with the best EIS indices, i.e., considered to be innovation leaders and strong innovators, also have the highest GDP per capita ratios.

The share of the agri-food sector in the total value added in the Western Balkan economies is highly relevant. It varies from 25% in Albania to slightly above 10% in Montenegro and Bosnia and Herzegovina. However, in most economies these shares have been on a decreasing trend since 2012, except in Albania. Figure 1 shows the share of value added in the agri-food sector as a percentage of the sum of gross value added in the cumulated NACE industries A to N.

Figure 1. Value added shares of the agri-food sector



Source: Matusiak et al., 2022.

The downward trends are also observed in employment in Bosnia and Herzegovina and Serbia, and to a lesser extent in Albania and North Macedonia. On the other side, employment levels in the agri-food sector have increased in Montenegro and Kosovo.

In relation to exports for the agri-food sector, all Western Balkan economies show a stable comparative advantage over time, except for Montenegro and Kosovo which show a downward trend in recent years. Looking at the structure of the value-added of gross exports of agri-food products of the six economies, the domestic value-added content is around 90% in Albania and Kosovo (with a downward trend). It is lower in Montenegro (around 80%), Bosnia and Herzegovina, North Macedonia and Serbia (around 70%). The foreign value-added content of exports is dominated in all cases by the EU-27, but in some economies (e.g., Serbia and North Macedonia) even more by other countries (i.e., the rest of the world), while the share of the Western Balkan economies is always marginal. Montenegro is the economy with the highest backward linkages, at around 4%.

Backward linkages with the other economies of the Western Balkans, as measured by the value-added content of each economy's exports, are relatively small in all economies: between 1.5% and 2.5% in most cases. Moreover, the linkages with the Serbian economy dominate all the others. When analysing the relative position in global value chains, we observe that backward linkages are stronger in most cases, except in Albania. Albania is characterised by less strong backward linkages, which is in line with the high domestic value-added content of exports.

Looking in detail at the main products exported, we have found that, despite certain similarities in agro-ecological conditions, competitiveness in vegetable production differs across the Western Balkans. Below are some of the conclusions obtained in this aspect:

- Albania, Montenegro and North Macedonia are classified as competitive or highly competitive in most vegetable sub-groups including pepper, cucumber, tomato, cabbage, tomato, bean and onion.
 - North Macedonia is the origin of 78% of all cabbage exports from the Western Balkan economies.
 - North Macedonia accounts for 60% of the regional pepper trade followed by Serbia with 27%.
 - The high quality of North Macedonian cabbage has secured its leadership position in the Western Balkan economies and a significant share of the EU market (6%).
 - Albania, which accounts for 5% of the Western Balkan economies market, has experienced the fastest growth in paprika production in the region.
- Bosnia and Herzegovina is competitive in potato, pepper, cucumber and cabbage exports;
- Serbia is competitive in carrot, cabbage, and pepper exports, but is relatively uncompetitive in other vegetables. Serbia accounts for 80% of the Western Balkan economies' carrot trade.
- The production of cucumber and gherkin is characterized by growth in most countries in the region. Serbia and Bosnia and Herzegovina are the largest exporters of gherkins.
- North Macedonia accounts for 48% of exports of cucumber and gherkin, followed by Bosnia and Herzegovina (25 %), Albania (11 %) and Serbia (11 %).
- Exports of onion and tomato represent approximately 1% of the EU market. Onion trade in the Western Balkan economies is dominated by North Macedonia (42 %) and Serbia (39 %), while North Macedonia (53 %) and Albania (25 %) are the leading tomato exporters in the region (World Bank, 2018).

Many of those products are exported raw or after only primary processing, such as flour milling of cereals or freezing the fruits and vegetables. As an example, Serbia exports different kinds of berries as wholesale, in packages of 5 -10 kg, and not in "retail-oriented" ready-made packaging or processed into functional value-added food products⁴. Raspberry and sour cherry produced in the Western Balkan economies are competitive as frozen products in the EU market. Plums and blackberries are also part of the same value chain because aggregators with cold storage capacity are purchasing and marketing several fruits. Fruit from the region is becoming increasingly competitive because the EU producers are giving up production of frozen fruit due to the intensive labour requirement for harvesting and the lower profits per ha compared to the fresh market or other fruit species. The competition among processors (cold storages with freezing capacities), which are the central point of small and stone fruit value chains for the frozen fruit market in the region. They operate as collection points, organizers of production, and also market the product. Most of the fruit exports from the Western Balkan economies is exported via EU intermediary import companies, which supply to EU processors or retail.

The other export path is direct marketing from the company owning the cold storage facilities to the EU retail and processors. Cold storage capacities with a freezing regime hold about 310 000 tons in Serbia, 30 000 tons in Bosnia and Herzegovina and 8 000 tons in Kosovo. In Bosnia and Herzegovina and Kosovo there are ongoing investments and expanding of cold storages, while in Serbia the process of concertation is ongoing. Fruit production is operated by smallholders, where family members actively participate during the harvest, and thus keeping labour costs relatively low compared to those in the EU area.

⁴ Smart Specialization Strategy of the Republic of Serbia for the period 2020 to 2027, "Official Gazette of the Republic of Serbia", No. 30/18

Apart from the primary production of fruit and vegetables, other types of agricultural production that take place in the Western Balkan include:

- Livestock, meat and milk production – it is based in small farms, which makes them important for the region but insufficiently competitive on the global market. The growth and competitiveness of the livestock and meat sector depends on how well the Western Balkans economies can meet the sanitary and food safety standards of the EU and other trade partners, such as e.g. Turkey.
- In recent years, Bosnia and Herzegovina has increased exports of crude and refined vegetable oil from the region, mainly to Turkey.

Concerning the foreign investment potential in the agri-food sector in the Western Balkans, the following should be emphasised:

- The FDI Intelligence portal⁵ lists 645 projects for cross-border greenfield investment in the Western Balkan economies in 2015-2020. Of these, 45 projects are in the agri-food sector (7%). Their total value is EUR 652 million (3% of all investment), and they employ 5 093 people in total (2% of employment). These figures are among the smaller ones for the other sectors, indicating that the agri-food sector is not particularly attractive for foreign investors.
- Most agri-food investment projects are located in Serbia, accounting for 75% in terms of the capital investment and for 71% in terms of employment. The share of the other economies ranges between 2% and 12%. This indicates that Serbia is by far the most attractive destination for foreign investors as far as the agri-food sector is concerned.

3.2 Scientific, research and innovation performance of the agri-food sector in the Western Balkans

The following analysis presents the strengths of Western Balkan economies within different phases of the agri-food value chain. Yet, the analysis had to make distinction among various economic sectors, since there were substantial differences between R&D commitment and related business success in different areas of the economy.

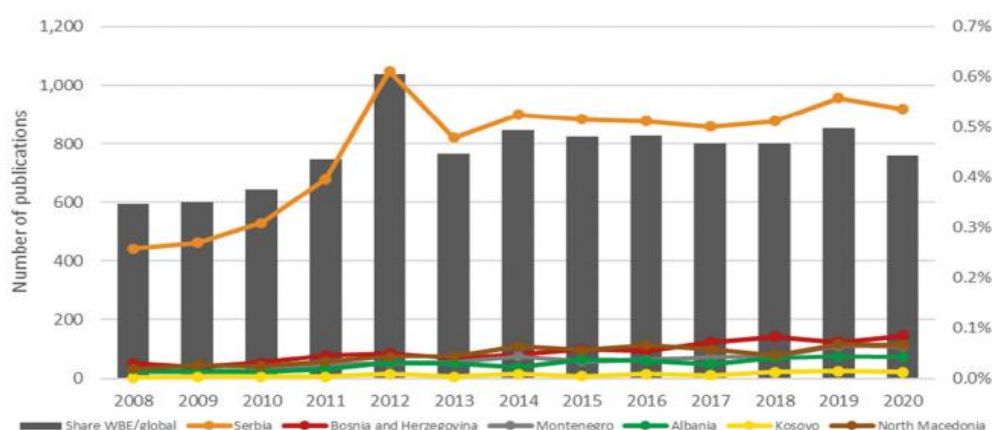
The agri-food industry holds a large share of institutions with a strong scientific specialisation potential in agricultural and biological sciences, which may increase regional innovation and technology diffusion in both the public and the private sector to increase productivity.

3.2.1.1 Patent activity

Patents are an indicator of the innovative activity within a specific sector and geographical region. Analysing the patent landscape in Western Balkan economies enables us to better understand the competitive environment of the target economies and value chains. Within this analysis, understanding the patentability activity of the region provides interesting insights to assess the level of innovation and the strengths and weaknesses of the target value chains. By performing a patent analysis of the agri-food sector, it noted an overlap among different technology areas. The most featured patents awarded during the period 2000-2020 belong to the cluster group A23L – Food, foodstuffs, or non-alcoholic beverages, as it is seen in the following figure.

⁵ <https://www.fdiintelligence.com/>

Figure 3. Scientific publications in the agri-food sector, 2008-2020

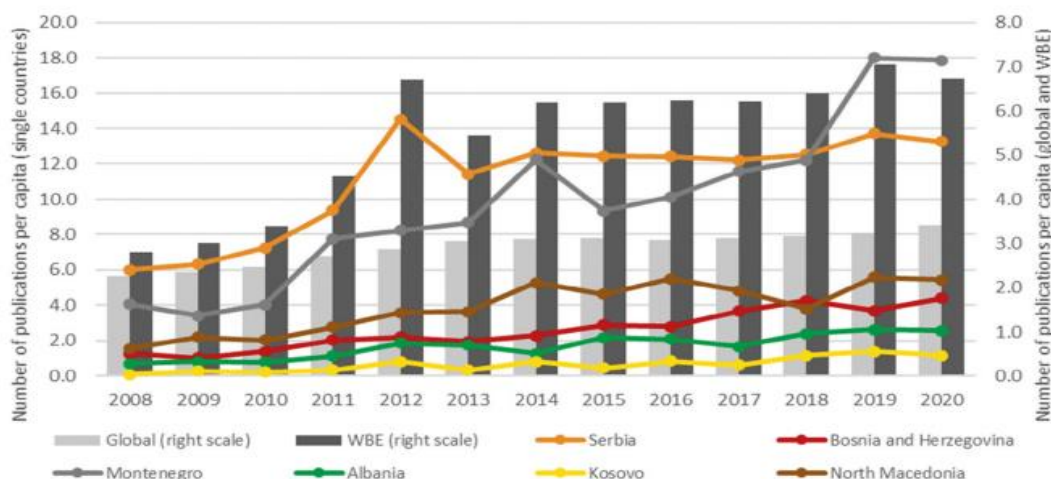


Note: WBE denote Western Balkan economies.

Source: Scopus (accessed March 2021); own calculations, in: Matusiak et al., 2022.

Nevertheless, when weighting in the number of the publications in relation to 100 000 inhabitants, Montenegro achieves 17.8 publications per capita, followed by Serbia with 13.3 (Figure 4).

Figure 4. Scientific publications per capita in the agri-food sector, 2008-2020



Note: WBE denote Western Balkan economies.

Source: Scopus (accessed March 2021); own calculations, in: Matusiak et al., 2022.

When analysing the scientific publications of the different Western Balkan economies universities, the most active organisations are the University of Belgrade with more than 5 500 scientific publications in the agri-food area, followed by the University of Novi Sad (Serbia) with more than 2 000, the University of Montenegro, the Institute of Field Crops and Vegetables in Novi Sad and the University of Niš (Serbia) with around 600 scientific publications.

Several conclusions and recommendations were drawn based on the analysis:

- Measures to increase scientific publications include actions addressing academia and R&D centres supporting their researchers to share and transfer knowledge with the agri-food value chain.
- Development of joint R&D&I projects with the participation of the industry should be encouraged, including the final users (farmers) in these projects.
- Performing matchmaking and brokerage events will foster the interaction between the stakeholders of the innovation value chain (researchers, industry, final users/farmers, policy makers and consumers).

These kinds of events enable the value chain to get to know the scientific developments of the researchers and, on the other hand, researchers get to know the industry interests and consumer concerns enhancing potential collaborations to develop R&D&I projects.

- Policy makers need to be in close contact with academia, industry, end users and consumers to develop the most appropriate programmes and policies to strengthen and improve the competitiveness of the sector.
- Initiatives to be considered for fostering technology transfer in the agri-food area in Europe include COST actions, Horizon Europe (Marie Curie Actions), COSME, EUREKA and ERASMUS+.
- Another measure to foster the publication of scientific papers is by enabling researchers to work in companies during a certain period. Companies should be willing to participate in R&D developments and employment programmes for PhD students, PhD degree holders and students of postdoctoral studies.

3.2.1.3 R&D cooperation projects involving the Western Balkans

The six economies of the Western Balkans are characterized by a significant number of small agricultural households and smallholders. There are also medium-sized processing companies and a slightly smaller number of large-scale processing companies, as well as traders and agricultural cooperatives. In most cases, actors in the value chain are domestically privately owned and are widespread across the Western Balkan region. Actors from the processing level are in domestic private ownership or mixed (private and foreign) ownership, but in most of the cases these are foreign-owned, and their owners are not from the Western Balkans. Connecting small agricultural households, smallholders, medium-sized and large-scale processing companies with medium-sized and large-scale processing companies needs to be improved through national and regional programmes and measures and activities of supporting institutions. To foster innovation and knowledge development driven ecosystems, Western Balkan economies have made progress in strengthening the policy framework on support of innovation. Some examples are the Albania's new Business Development and Investment Strategy (2021-2027), Strategy for SME Development 2021-2027 in the Federation of Bosnia and Herzegovina, Strategy for Supporting Innovation and Entrepreneurship (2019-2023) of Kosovo, Smart Specialisation Strategy of Montenegro (2019-2024) and the new Strategy on Scientific and Technological Development of the Republic of Serbia for the period 2021-2025.

Within the agri-food value chain, the research network of the Western Balkan economies includes cooperation with 160 countries. Research organisations in Serbia are the most active with a total of 10 256 joint publications, collaborate with partners from many international countries (153 out of total of 160). The strongest connections have been established with Croatia (604 joint publications), Italy (590 joint publications), and Germany (574 joint publications). Entities from Bosnia and Herzegovina, which comes second in this value chain, cooperate mostly with partners from Serbia (404 joint publications), Croatia (362 joint publications) and Slovenia (151 joint publications). Serbia is the main partner in scientific publications for organisations from Montenegro (254 joint publications) and North Macedonia (262 joint publications). Regarding European collaborations, Albania stands out for its close collaboration with Italian institutions (166 joint publications), followed by Serbian ones (107 joint publications). Even though the quantity of the scientific publications could be higher, data suggest that Western Balkan economies are quite interconnected in those terms, which presents a positive signal for the future development of regional scientific cooperation.

Among other initiatives aimed to enhance the regional cooperation, the Berlin Process⁶ recently provided a significant boost in those terms. At its summit in October 2022, six WB economies signed an agreement on mutual recognition of identity cards, as well as recognition of university degrees and professional qualifications, which provides for free movement, and enhanced and facilitated cross-border professional cooperation. It is meant to turn the region into an area of free movement of people, goods, services and capital, based on the EU example and standards, unlocking the region's economic potential and make it a more attractive investment destination and bring it closer to the EU. It is expected that the agreements and improved cooperation would have a strong positive impact on the agri-food industry, among others.

In all Western Balkan economies there are few entities with several projects and several entities with few or only one project. It is observed that they collaborate with each other and with different European countries. At the

⁶ Launched in 2014, the Berlin Process presents an initiative of several EU Member States, under German leadership, to engage with the six Western Balkan partners and promote regional cooperation and the European perspective of the region.

international level they have links mainly with the USA and other EU candidate countries such as Turkey. Within Asia, collaboration with Azerbaijan is frequent among the Western Balkan economies.

3.2.1.4 Funding opportunities for innovation

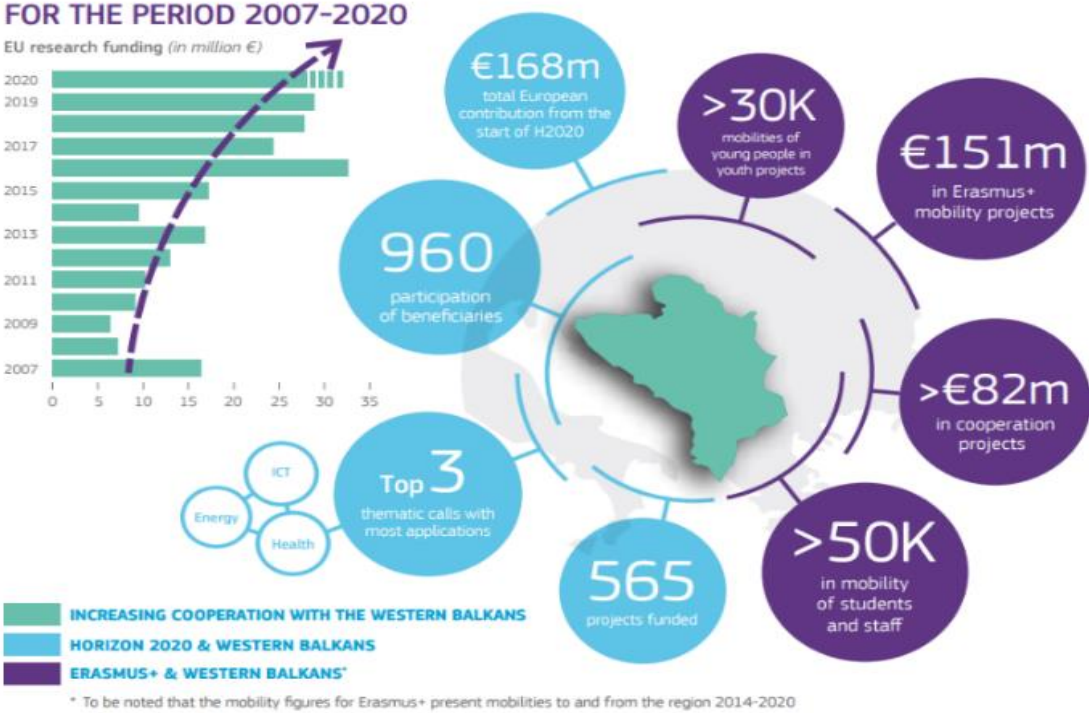
The R&I policy in the Western Balkan economies for years was mainly affected by the availability of development programmes related to EU enlargement and financing funds. Regional cooperation to provide certain R&I-related resources, such as, for example, research and innovation infrastructure, would be a cost-effective way to help SMEs grow beyond their national capacities.

To develop the potential of the agri-food sector, the governments of the Western Balkan economies have made progress scaling up financial support for innovation activities in SMEs. Successful examples can be found in the operational activities of the Serbian Innovation Fund, the Start-up Fund of Albania managed by AIDA, the Challenge to Change Fund of the Federation of Bosnia and Herzegovina, the Innovation Programme for Grants and Innovative Projects of Montenegro, and the Fund for Innovation and Technological Development of North Macedonia.

However, compared to other European regions, innovation efforts in the Western Balkans should be exploited more. Policy governance in the field of research and innovation has been gradually established through international cooperation and, to a large extent, through EU-funded programmes and projects or as part of enlargement policy. It is also important to mention that the implementation of ‘greener policies’ in the Western Balkan economies remains limited overall. Initiatives should be implemented to make SMEs aware about the advantages of greening their activities to improve productivity and reduce their environmental impact.

The following graph demonstrates the growth of research and development projects financed by the EU during the period 2007-2020. Financing through European funds has doubled in the last decade. Stronger growth appears inevitable as the EU accession process progresses and the commitment to the single European market and confidence in the EU incentives increase.

Figure 5. EU research and innovation funding 2007-2020



Source: European Commission

IPARD programme and Horizon 2020 are among the key EU support programmes for the agri-food area in the Western Balkans. The impact of the IPARD fund and Horizon 2020 funding programmes on the Western Balkan economies provides the following assumptions:

1) Participation of the Western Balkan economies in the IPARD programme:

The EU is the largest donor, trade partner and investor in the Western Balkan economies, in accordance with the European perspective of the entire region. In the area of agriculture, the strongest incentives are from IPARD programmes, as an integral part of the broader EU pre-accession strategy under the Instrument for Pre-Accession Assistance (IPA). Through this tool, the EU provides beneficiary countries with financial and technical help, with the aim of developing their crops, food production and rural development structures in a sustainable way, aligning their agricultural and rural development policies with the EU's common agricultural policy and adapting their agriculture and food sector with the EU food, hygiene and environmental standards.

IPARD provides the basis for EU support in the field of agriculture, rural development and food security for the period 2021-27, particularly important in the current geo-political context. EU support, together with national public and private contributions, are expected to generate in total over €2 billion investment in rural areas of Western Balkan economies. IPARD programmes are also a clear sign of the EU's support in investing in agriculture and rural development in the Western Balkan economies and in Turkey, to strengthen their resilience.

With the implementation of IPARD programmes, beneficiary economies pursue their objectives related to increasing competitiveness of the agri-food sector, sustainable management of natural resources, climate action and improving attractiveness of their rural areas. The programmes also contribute to the objectives of the Green Agenda for the Western Balkan economies and the Green Deal more broadly. Furthermore, IPARD programmes support investments to align with EU standards, including upgrading buildings, machinery, and equipment. They also help establishing short supply chains, increasing rural areas growth potential and their attractiveness to prevent depopulation via better infrastructure, diversifying income-generating economic activities and fostering rural employment, in particular among women and youth.

Table 1. Analysis of the impact of IPARD funds for the agri-food sector in Western Balkan economies

Western Balkan economy	IPARD Current measures	Budget IPA II (M€)	IPARD II Budget (M€)	Number of projects supported	Total investment generated via IPA in agri-food sector and rural development (B€)	Number of jobs created	Main conclusions
Serbia	<p>Measure 1: "Investments in physical assets of agricultural holdings"</p> <p>Measure 3: "Investments in physical assets concerning processing and marketing of agricultural and fishery products"</p>	EUR 1404,4	EUR 175	834	EUR 66	260	<p>On rural development, Serbia is entrusted with budget implementation tasks for four measures under the IPARD II Programme. However, implementation of the 'Technical assistance' measure is still pending.</p> <p>Delays in payments under the IPARD II Programme in 2021 resulted in a loss of EUR 3.7 million of IPARD funds, with considerable risk of further losses in 2022 and 2023. It is important that Serbia fully implements its action plan for better absorption of funds. The spending of EU funds under IPARD should be a priority to avoid financial de-commitments and the filling of vacant posts is essential for improved and timely processing of IPARD applications. Serbia's IPARD III programme was prepared in an efficient and timely manner and approved by the European Commission in March 2022.</p> <p>There are still 99 vacant positions from the 232 posts dedicated to IPARD within the Directorate of Agrarian Payments (IPARD Agency).</p> <p>Preparation for the implementation of the new measures under the programme, 'Agri-environment-climate and organic farming', 'Implementation of local rural development strategies (LEADER)' and 'Investments in rural public infrastructure' needs to start well in advance of their planned entrustment with budget implementation tasks.</p>

Western Balkan economy	IPARD Current measures	Budget IPA II (M€)	IPARD II Budget (M€)	Number of projects supported	Total investment generated via IPA in agri-food sector and rural development (B€)	Number of jobs created	Main conclusions
North Macedonia	<p>Measure 1: "Investments in physical assets of agricultural holdings"</p> <p>Measure 3: "Investments in physical assets concerning processing and marketing of agricultural and fishery products"</p> <p>Measure 7: "Farm diversification and business development"</p> <p>Measure 9: "Technical assistance"</p>	EUR 633	EUR 60	1657	EUR 50	2300	<p>On rural development, good progress was made in the absorption of EU funds under the Instrument for pre-accession assistance for rural development (IPARD II). However, the number of staff in the Managing Authority and IPARD agency needs to be increased.</p> <p>The IPARD III programme has been adopted and greater operational commitment is needed by the IPARD authorities to expand the number of measures available to farmers and rural areas to make use of the increased budget allocation under IPARD III.</p>

Western Balkan economy	IPARD Current measures	Budget IPA II (M€)	IPARD II Budget (M€)	Number of projects supported	Total investment generated via IPA in agri-food sector and rural development (B€)	Number of jobs created	Main conclusions
Albania	<p>Measure 1: "Investments in physical assets of agricultural holdings"</p> <p>Measure 3: "Investments in physical assets concerning processing and marketing of agricultural and fishery products"</p> <p>Measure 7: "Farm diversification and business development"</p>	EUR 758	EUR 71	760	EUR 145,5	800	<p>Increasing the competitiveness of the agricultural and agri-food policy through the application of the agricultural and the rural development policies should improve quality of life in rural areas. The contribution should come also through improving national standards in accordance with the European standards regarding the fruit and vegetable and dairy meat of the farms.</p> <p>Support for agri-tourism should be strengthened.</p> <p>Increasing the number of applications by women will impact the growing number of women entrepreneurs in Albania.</p> <p>The national agriculture budget continues to be low.</p>
Montenegro	<p>Measure 1: "Investments in physical assets of agricultural holdings"</p> <p>Measure 3: "Investments in physical assets"</p>	EUR 269,2	EUR 39				<p>On rural development, 9 IPARD calls under the IPARD II programme were realised in total (3 new calls in the reporting period), for the measures 'Investments in physical assets of agricultural holdings', 'Investments in physical assets concerning processing and marketing of agricultural and fishery products' and 'Farm diversification and businesses development'.</p> <p>The IPARD measure 'Technical assistance' was submitted for entrustment in February 2022. Slow implementation led to the first</p>

Western Balkan economy	IPARD Current measures	Budget IPA II (M€)	IPARD II Budget (M€)	Number of projects supported	Total investment generated via IPA in agri-food sector and rural development (B€)	Number of jobs created	Main conclusions
	concerning processing and marketing of agricultural and fishery products"						<p>de-commitment of funds after the end of the financial year 2021 and there is a considerable risk of further loss of IPARD funding. Therefore, stronger efforts are needed to fully absorb the funds in 2022 and 2023.</p> <p>Montenegro's IPARD III programme was approved by the European Commission in June 2022. Strengthening of the administrative capacity of the IPARD Agency in 2022 was supported with an amendment of the Systematization Act of the MAFWM, stipulating additional 25 posts for the IPARD activities.</p>
Bosnia and Herzegovina	N/A	EUR 539,6	N/A				<p>For the country to benefit from the instrument for pre-accession assistance for rural development (IPARD) programme, the authorities need to agree to set up the necessary institutional structures.</p> <p>Direct payments still need to be aligned with the EU rules through decoupling them from production and linking payments to cross-compliance. The country needs to develop farm advisory services.</p>
Kosovo	N/A	EUR 573,1	N/A				<p>The agriculture and rural development programme implemented in 2021 included important support for investments in agricultural households, processing and marketing of agricultural products, farm diversification and business development in rural areas, and on farm irrigation. Cross-compliance remains to be addressed.</p> <p>On rural development, the strategy for agriculture and rural development 2022-2028 has been adopted by the government. However, the agriculture and rural development programme 2022- 2027 still needs to be adopted.</p>

Source: DG NEAR, European Commission

2) Participation of Western Balkan economies in the Horizon 2020:

Horizon 2020 was structured in three main pillars, which, in turn, were structured into different lines or areas:

- Pillar 1 “Excellent Science” sought to foster the generation of world-class research ecosystems. This was implemented along the following main lines:
 - *European Research Council* where promising researchers were encouraged to pursue careers in totally disruptive technologies.
 - *Future and Emerging Technologies* where the EC focused on certain technologies considered to be future or emerging technologies such as high-performance computing, nanotechnology, robotics...
 - *Marie Skłodowska - Curie Actions* fostered the exchange of knowledge between the EU research institutes.
 - *Research Infrastructures* to create a network of relevant research infrastructures in promising technologies.
- Pillar 2 “Industrial Leadership” aimed at improving the competitiveness of European industry, especially SMEs, through a combination of European public and private (investors and European Investment fund) funding mechanisms. This pillar was structured along the following lines:
 - *Leadership in enabling and industrial technologies* where SME-driven projects in enabling industrial technologies were financed such as biotechnology, space, etc.
 - *Access to risk finance and Innovation in SMEs supported projects* developed by SMEs with a totally disruptive business model in Europe and international markets and with great potential for economic growth.
- Pillar 3 “Societal Challenges” which sought to solve major societal challenges by funding collaborative innovation projects between industry, academia and end users. Different societal challenges addressed by this pillar were:
 - Health;
 - Food;
 - Energy;
 - Transport;
 - Climate;
 - Inclusive Societies;
 - Security.

We analysed the activity in the Western Balkan economies in terms of participation in H2020, in pillar 3 - "Societal Challenges" and in concrete “Food” challenge. The following table presents the relevant findings.

Table 2. Analysis of the participation of entities from the Western Balkan economies in the H2020 framework programme

Economy	Top 3 societal challenges in H2020 signed grants	(a) ⁷	(b) ⁸	(c) ⁹	(d) ¹⁰	Main keywords in the H2020 agri-food projects	Main partners for collaboration projects in agri-food
Serbia	1. Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and bioeconomy, 2. Secure, clean and efficient energy, 3. Health, demographic change and wellbeing.	31%	10,07	46	40	1. Environment, resources and sustainability 2. Agrobiodiversity 3. Food quality 4. Food safety 5. Knowledge transfer 6. New business opportunities 7. Socio-ecological systems 8. Supply chain management	- with other WB economies: Bosnia& Herzegovina, Montenegro - with other countries: EU, Ukraine, Israel, Russia, Uzbekistan, Kyrgyzstan, Azerbaijan, North Korea, Philippines
North Macedonia	1. Secure, clean and efficient energy, 2. Health, demographic change and wellbeing, 3. Climate action, environment, resource efficiency and raw materials.	16%	0,8	6	4	1. Bioeconomy 2. Food safety	- with other WB economies: Albania, Montenegro, Serbia - with other countries: EU, Turkey, USA, Trinidad& Tobago, Azerbaijan, North Korea, Philippines
Albania	1. Climate action, environment, resource efficiency and raw materials, 2. Europe in changing world, inclusive, innovative and reflective societies	15%	0,244	3	4	1. Animal health 2. Food safety 3. Knowledge infrastructure	- with Other WB economies: Bosnia and Herzegovina, Montenegro, Serbia - with other countries: EU, Turkey, Israel, USA, Azerbaijan

⁷ % of Agri-food projects in relation to total H2020 signed grants.

⁸ Net H2020 Contribution (M€) to "Food Security, sustainable agriculture and forestry, marine and maritime and inland water research and the bioeconomy" (Total H2020, Pillar 3 "Food" challenge funding obtained).

⁹ No. of signed grants related to "Food Security, sustainable agriculture and forestry, marine and maritime and inland water research and the bioeconomy" (Total H2020, Pillar 3 "Food" challenge funding obtained).

¹⁰ Unique participants in projects related to "Food Security, sustainable agriculture and forestry, marine and maritime and inland water research and the bioeconomy" (Total H2020, Pillar 3 "Food" challenge funding obtained).

Economy	Top 3 societal challenges in H2020 signed grants	(a) ⁷	(b) ⁸	(c) ⁹	(d) ¹⁰	Main keywords in the H2020 agri-food projects	Main partners for collaboration projects in agri-food
	3. Health, demographic change and wellbeing.						
Montenegro	1. Secure societies-protecting freedom and security of Europe and its citizens, 2. Health, demographic change and wellbeing, 3. Clean and efficient energy.	14.2%	0,21	2	2	1. Agriculture related to animal husbandry, dairying, livestock raising 2. Animal health	- with other WB economies: Bosnia and Herzegovina, Montenegro, Albania, North Macedonia, Serbia - with other countries: EU, Turkey, Israel, Iceland, USA, Russia, Algeria, Egypt
Bosnia and Herzegovina	1. Secure, clean and efficient energy, 2. Climate action, environment, resource efficiency and raw materials, 3. Europe in changing world, inclusive, innovative and reflective societies.	7%	0,169 9	1	1	Agriculture related to crop production, soil biology and cultivation, applied to plant biology (1 H2020 project)	- with other WB economies: Kosovo, Montenegro, Albania, North Macedonia, Serbia - with other countries: EU, USA, Iceland, Israel, Japan, Azerbaijan
Kosovo	1. Europe in changing world, inclusive, innovative and reflective societies, 2. Health, demographic change and wellbeing, 3. Climate action, environment, resource efficiency and raw materials.	No HORIZON 2020 collaborative projects for agri-food sector in Kosovo.					

Source: European Commission.

The analysis showed that only Serbia cited “Food” as a top challenge for H2020 Pillar 3 projects. Although the other Western Balkan economies have implemented projects in the agri-food sector, they have been more active in other H2020 Pillar 3 societal challenges. Serbia has also attracted the most funds from Horizon 2020 and specifically for the agri-food sector, from the Western Balkan economies. In general, the share of participation in Horizon Europe of the Western Balkan economies is low.

4 Challenges and opportunities for collaboration in the agri-food area in the Western Balkan economies

Traditionally, there has been well-developed cooperation among the Western Balkan economies concerning the exchange of agricultural and food products. This cooperation could be further enhanced by liberalizing trade relations and fostering more intensive collaboration between support institutions. The improvement in cooperation among the Western Balkan economies is evident in the free flow of products. The free flow of services is conditioned by the Central European Free Trade Agreement (CEFTA), while in the domain of the free flow of capital, there is significant room for improvement. Intensive efforts are being made to enhance work and residence permits, allowing labor to flow freely among the Western Balkan economies. This is crucial due to the region's specific needs for a skilled workforce, which is currently in shortage.

Viewing the region as a single market and in a synergetic sense, strengthening economic relations is a prerequisite for addressing the migration of active labor to developed countries and the potential loss of skilled workers, already in shortage within the Western Balkan economies.

A significant stride has been made by including the Western Balkan economies in the System of Green Corridors, proving to be an effective mechanism for regional connectivity, especially during the COVID-19 pandemic. Additionally, the initiative by European countries to 'shorten' supply chains presents a significant opportunity to fortify existing value chains and establish new ones among the Western Balkan economies. Shortening supply chains would enhance resilience against external shocks, particularly beneficial for value chains in the agri-food sector due to the nature of production, relying on raw materials and products with limited shelf life.

To overcome the barriers faced by actors at different levels of national policy within the agri-food sector's value chain, encouraging the development and implementation of innovative technological solutions is essential. This alignment of production systems with international food quality standards would reduce export barriers and increase the added value of agri-food products. Crucially, cooperation between support institutions is vital. This collaboration could be fortified by establishing regional support organizations in the agri-food sector, involving both the public and private sectors in dialogue to address regional issues. Under the auspices of a reputable international organization, such collaboration would significantly contribute to a more robust response and implementation of conclusions.

Demographic changes, green transformation, digitalisation, and geopolitical shifts, among other factors, have been identified as key external influencers on the development of global value chains. Each of these factors affects businesses in the agri-food sector. Just as organic production in agriculture has set higher standards, the green transformation will similarly elevate expectations. Digitalisation and automation may exert the most intense impact, the speed of which remains unpredictable. Geopolitical factors are the primary constraints on growth at the global level, and their impact is also felt in the Western Balkan economies. Although free trade growth should ensure sustainable long-term global growth, recent trends have seen foreign trade growing more slowly than GDP due to economies leaning towards self-sufficiency. Consequently, less developed economies in the Western Balkans are more susceptible to geopolitical risks.

4.1 Production of high value products

In the Western Balkans, there is a need to progress towards a higher degree of production completion and to transition from being importers of agricultural products to becoming exporters of food. High-value products play a significant role in the further development of the food industry, encompassing several different groups of food products that are experiencing increasing demand in both domestic and, specifically, foreign markets. These include:

- Functional food marked by one or more nutritional or health statements (rich in fibre, protein, minerals, antioxidants, etc.).
- Enriched food with added nutrient(s) from natural sources that are essential to the modern consumer's diet.
- Fortified food with added nutrients deficient in the consumer's diet.
- Organic products emphasizing a shift from certified primary agricultural products to processed organic products (frozen organic products, organic dairy products, etc.).

- Foods for special dietary use, such as gluten-free products, items for diabetics, or products designed for various consumer groups such as athletes, children, etc.
- Products for the food production industry (modified starches, bakery product mixtures, etc.).
- Items derived from raw materials with special characteristics protected by geographical origin labels (GI food).
- Products obtained using traditional methods (traditional food).
- Products adapted for easier consumer use/high convenience food (tea in the form of a teabag).
- Products with extended durability preserving nutritionally valuable components of raw materials (lyophilized fruit).

Numerous products from these groups already form a part of the product range of successful food producers. Some of these products are exported, primarily to neighbouring countries, while there are also instances of successful exports to more distant markets. A considerable number of researchers in Serbia focus on developing various value-added products, further strengthening this area. However, mechanisms need to be established for many existing results from this research to be effectively transferred to the industry.

4.2 Digitalisation of the agri-food value chain

The agri-food sector is facing new challenges and demands, primarily related to the impact of climate change on food production and the necessity to produce more nutritious food for the growing global population. Digitalisation will play a crucial role in modernizing this sector, enhancing efficiency, and facilitating the production of higher-value food for consumers. Digital technologies are expected to enable comprehensive and more efficient management of key resources in the agri-food sector (water, fertilizers, pesticides, animal feed, animal treatments) in a manner that minimizes the sector's impact on climate change and yields healthier, chemical-reduced food for consumers.

High-tech technologies allow for achieving yields per unit of arable land that surpass traditional production methods by several times, reducing dependence on agro-climatic conditions and climate changes, and meeting the increasingly stringent quality demands of modern consumers and distribution chains. High Technology Farming encompasses a broad range of innovative tools such as Robotics, ICT, Big Data, etc., and their synergistic utilization leads to the new paradigm of Sustainable Precision Agriculture (SPA).

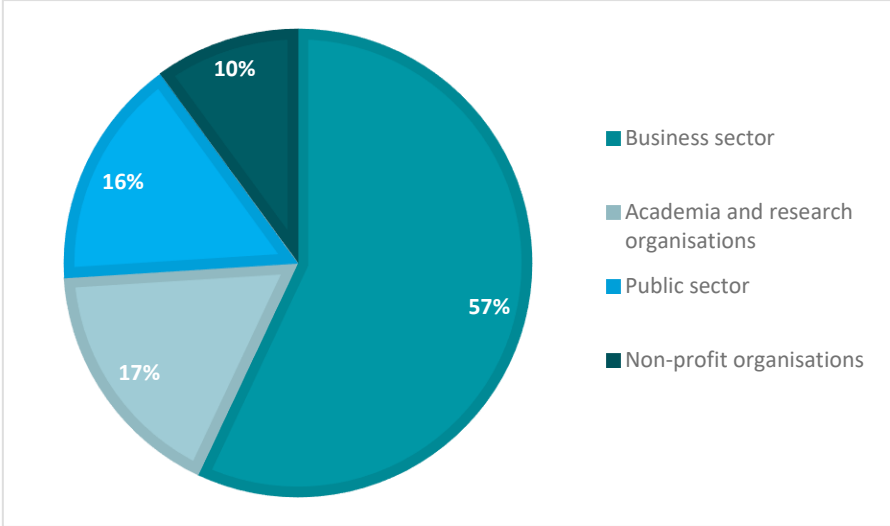
The primary objective of digitalisation in the agri-food sector is to promote collective efforts aimed at expediting the adoption of advanced technologies that can enhance the sector's performance. The development of modern plantations is complemented by the construction of storage capacities - cold storage, ULO (ultra-low oxygen) cold storages, or processing capacities (wineries) owned by the manufacturers, facilitating direct market access. Despite the prevalence of conventional production in the agricultural structure, opportunities for bolstering agriculture lie in transitioning to high-tech agriculture, encompassing various fruits, vegetables, and horticultural plants. While field crops dominate in terms of production and export quantities, significant development potential exists in high-tech agriculture. However, the application of modern agricultural techniques and the adoption of agrarian policy measures are necessary to enhance this area, given that available arable surfaces currently favour field crop production.

High-tech agricultural production necessitates new resources, consequently fostering innovation across ancillary activities – such as seed and crop production, mineral and microbiological fertilizer production, infrastructural crop elements (pillars, nets, irrigation systems), manufacturing of measuring and control equipment (sensors, data loggers, information systems for data collection, processing, and management), growth regulators, biological and chemical agents for pest and disease control, packaging production, logistics systems, etc. Products derived from high-tech agriculture have gained recognition as highly competitive in the market. There exists a pool of domestic experts connected with manufacturers, and funding expansion in this type of production is planned through pre-accession funds (IPARD). Given numerous other advantages, this area has been identified as a potential for development.

5 Results of the survey

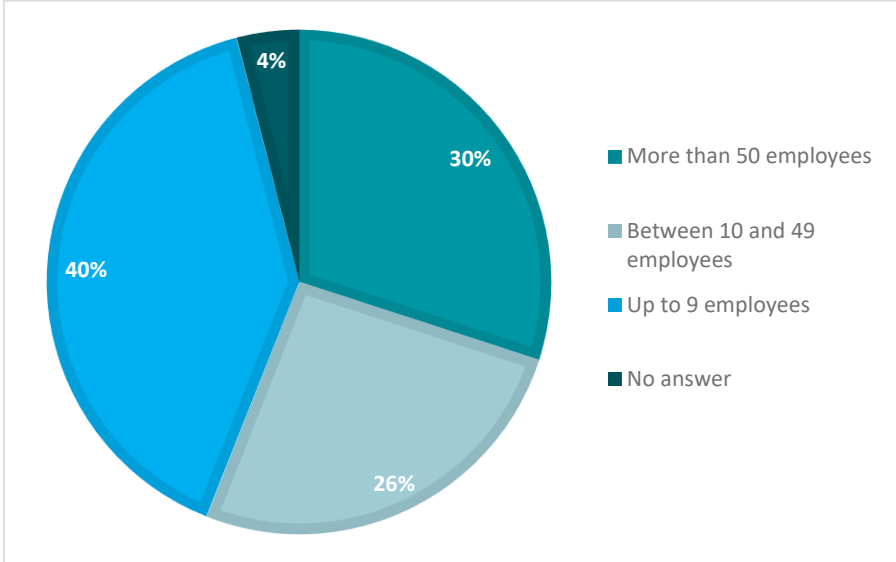
The survey included key stakeholders from five Western Balkan economies in accordance with the methodology. A total of 95 responses were collected and the requirement of a minimum of 15 responses per country was met. More than half of respondents were from the business sector. The detailed graph of the respondents is given in the figure below.

Figure 6. Type of respondents to the survey



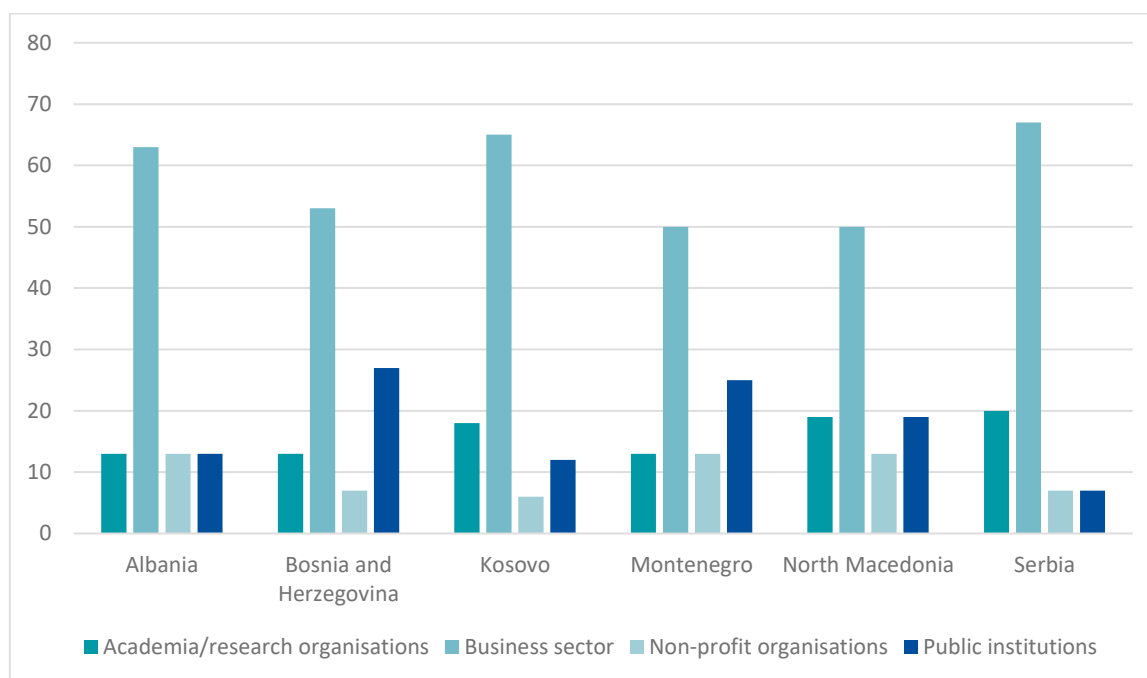
Source: authors

Figure 7. Size of the respondents to the survey



Source: authors

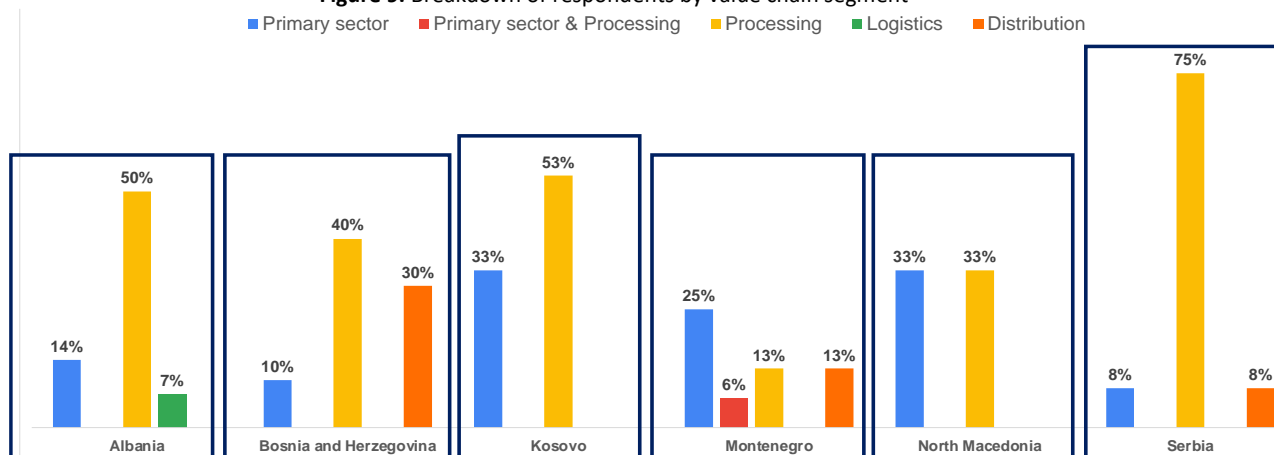
Figure 8. Type of entities per Western Balkan economy



Source: authors

The majority of respondents from the agri-food value chain businesses in the Western Balkans primarily belong to the processing sector. However, in Montenegro, the largest number of respondents were from the primary sector.

Figure 9. Breakdown of respondents by value chain segment



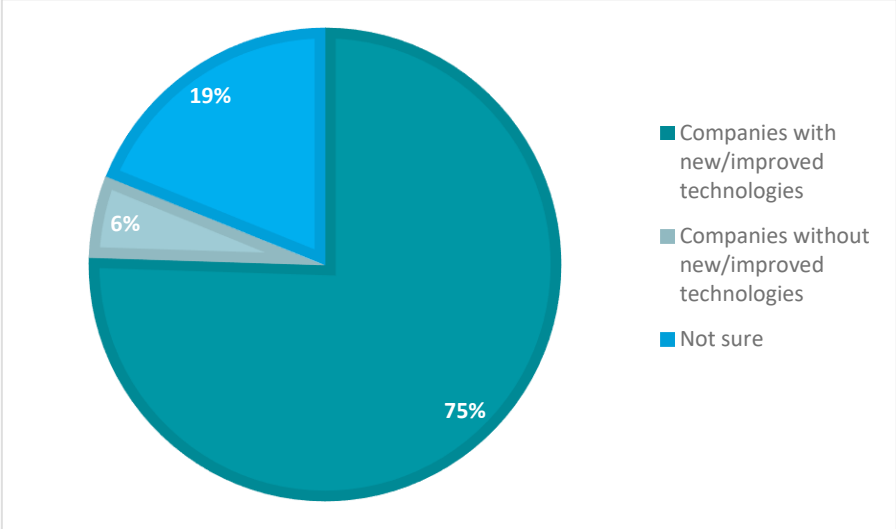
Source: authors.

In terms of the detailed structure within the primary sector respondents, 73% are involved in crop production, 16% in aquaculture, and 5% in animal production. However, the primary sector remains significant across all economies. In terms of specific production types:

- 73% of respondents are involved in crop production, with 80% focused on fruit, vegetables, and cereals. Only 10% indicated primarily irrigated land use for crop production.
- 16% are engaged in aquaculture.
- The remaining 5% are involved in animal production, particularly in poultry and chicken farming.

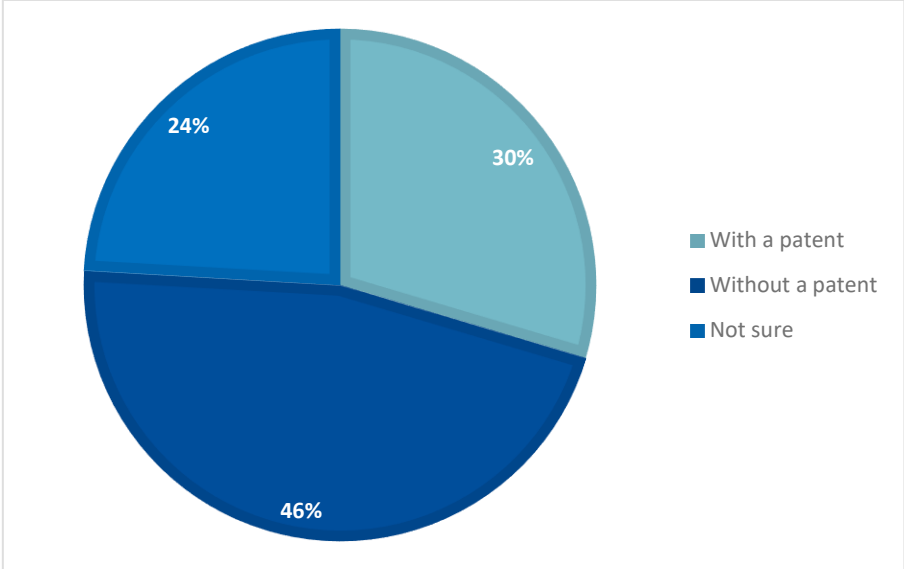
The section of the survey dedicated to analyzing scientific and innovation perspectives revealed intriguing insights regarding intellectual property and patents. Notably, a majority of companies in the agri-food sector responded affirmatively when asked about implementing new or enhanced technology in their operations or their intention to invest in technology in the near future. However, less than a third of respondents confirmed recent acquisition of patent protection (see figures 10-12).

Figure 10. Share of companies that introduced new or significantly improved technology in the last five years



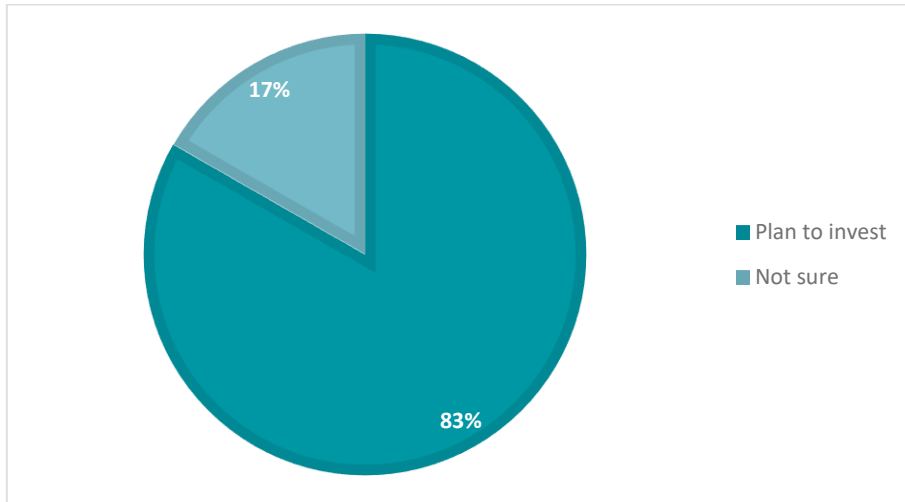
Source: authors

Figure 11. Proportion of companies granted patent protection within the past five years



Source: authors

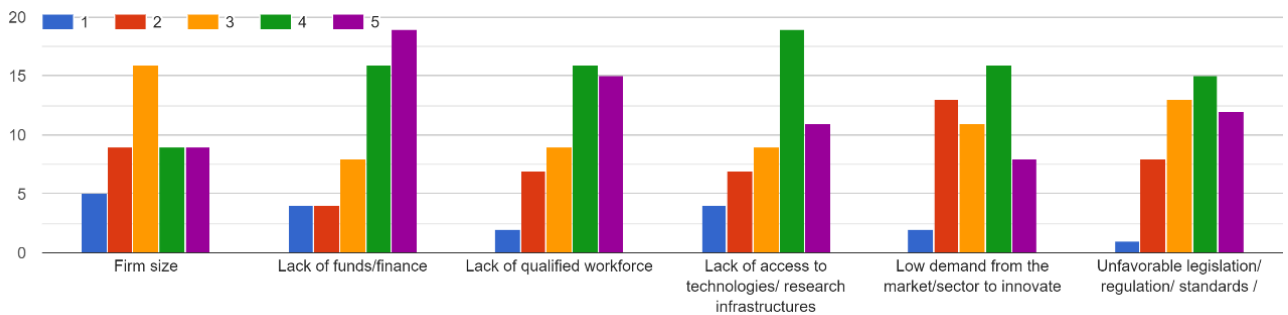
Figure 12. Share of companies that plan to invest into technologies in the next three years



Source: authors

The most common reasons hindering innovation activities in the business sector include insufficient funds, a scarcity of skilled workers, and limited access to technologies or research infrastructures. The graph below illustrates feedback from all respondents regarding the extent to which these factors impede their companies' innovation activities.

Figure 13. Factors impeding innovation activities in the Western Balkans

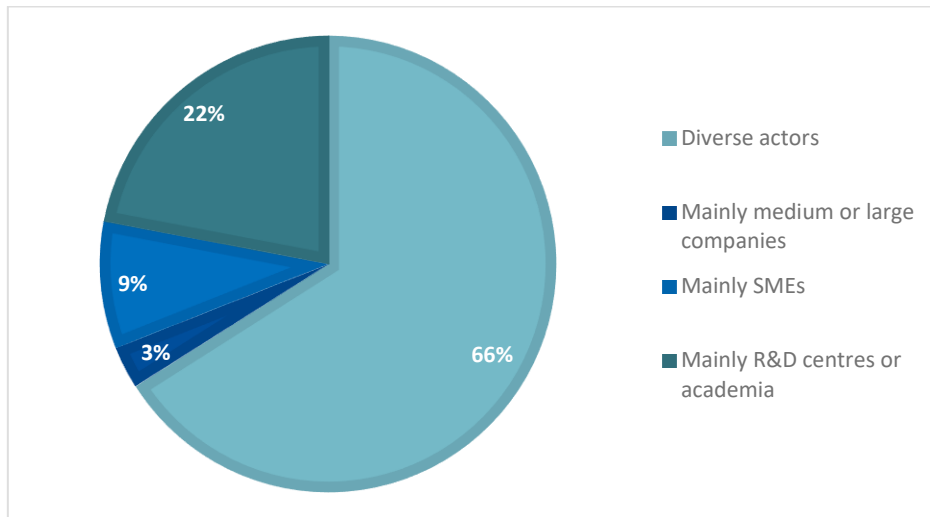


Note: colour boxes in the upper left corner denominate the relevance (1 – not relevant, 5 – highly relevant) while the left axis represents the number of responses

Source: authors

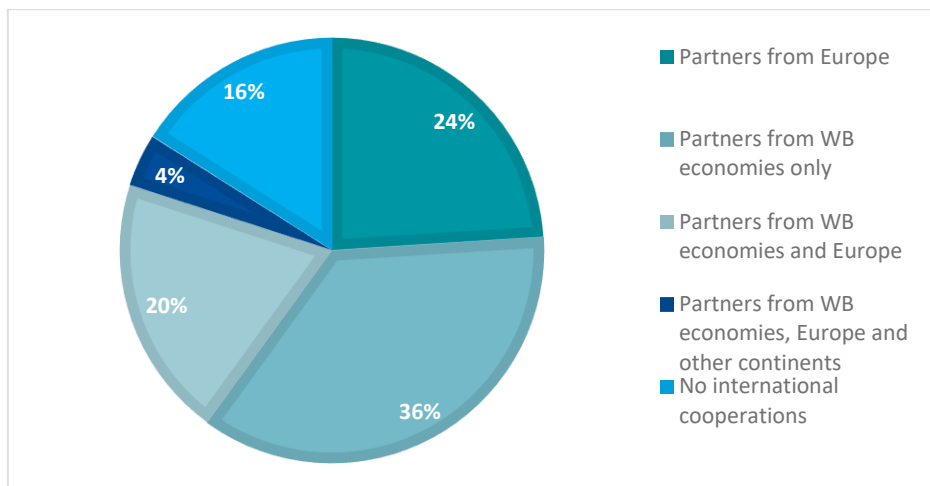
Altogether, 54% of respondents stated they engage in collaborative R&D activities with external entities, with 36% of them indicating their primary partners in these activities are from the Western Balkans. Detailed results are presented in the following figures.

Figure 14. Structure of partners in R&D collaborative activities among respondents



Source: authors

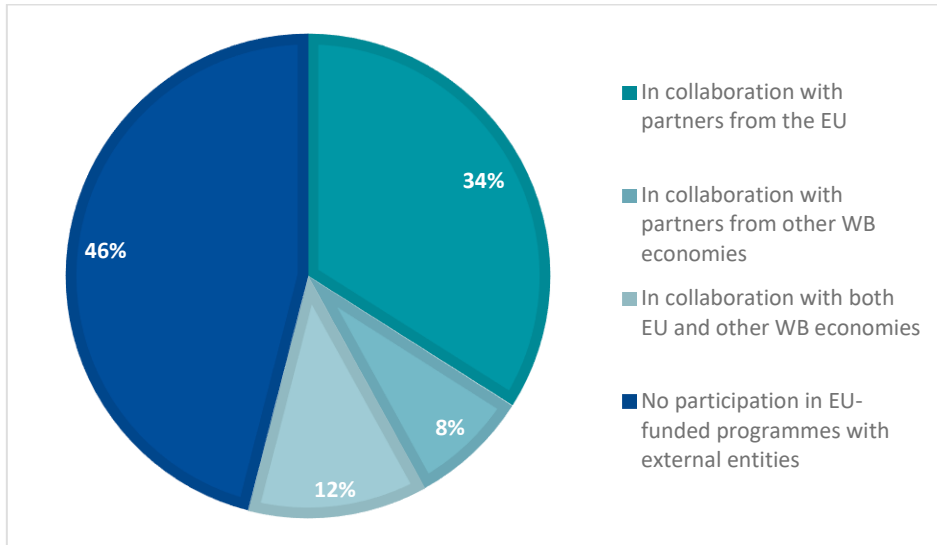
Figure 15. Geographical distribution of R&D collaborations among respondents



Source: authors

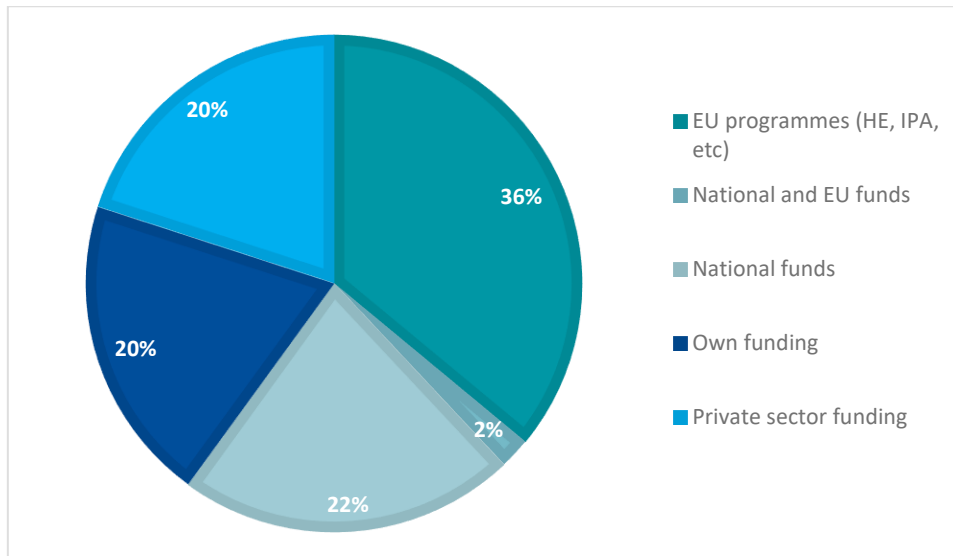
The online survey also examined collaborations among Western Balkan agri-food stakeholders in European programmes, particularly Horizon Europe. The results indicate that over half of the entities participated in European programmes and engaged in collaborations with other foreign entities (see next figure for more details).

Figure 16. Collaboration in EU-funded programmes of the Western Balkans entities, 2017-2022



Source: authors

Figure 17. Sources of financing for innovation in the agri-food area in the Western Balkans



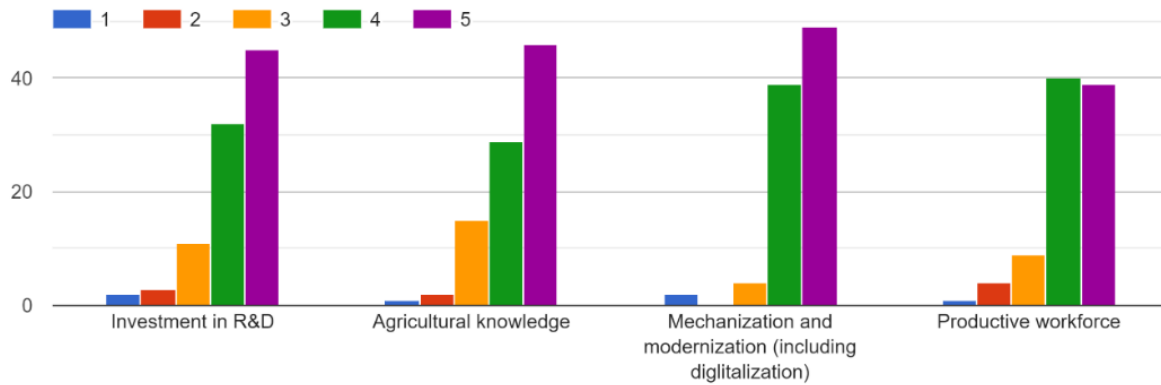
Source: authors

In terms of private sector funding, 71% of participants mentioned banks, while private investors and business angels accounted for 27%, placing them second.

The survey also aimed to identify factors influencing the selection of agri-food as the common Smart Specialisation priority area in the Western Balkans. Aligned with the proposed policy orientation of the Western Balkan economies and discussions from the 2021 workshop, which highlighted agri-food as a common priority in the region, the questionnaire sought to verify crucial drivers for the sector's growth.

As per the survey findings, the most significant factor contributing to the productivity growth of the agri-food sector in the Western Balkan economies was mechanisation and modernisation, including digitalisation. Detailed results are provided in the following figure.

Figure 18. Most relevant factors of productivity growth of the Western Balkans agri-food sector



Note: the colour boxes in the upper left corner indicate the relevance scale (1 – not relevant, 5 – highly relevant), while the left axis represents the number of responses.

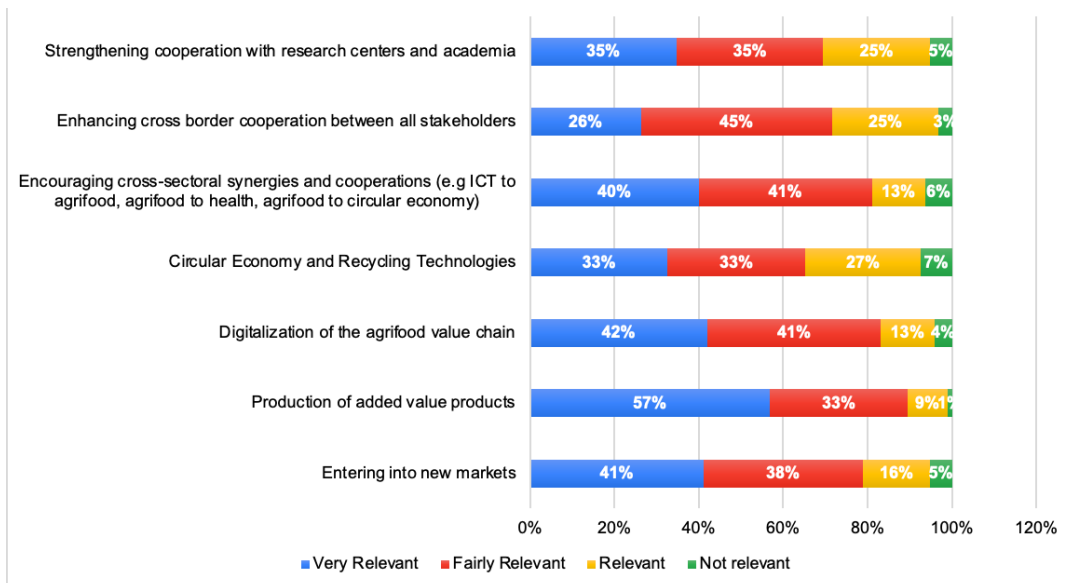
Source: authors

In the context of the Smart Specialisation exercise, the most common sub-areas in the Western Balkans' agri-food sector include: 1) Digitalisation of the agri-food value chain, 2) Production of value-added products, and 3) Encouraging cross-sectoral synergies and cooperation. When respondents were asked about untapped opportunities for the sector's growth in the region, the following options were provided:

- Entering new markets,
- Production of value-added products,
- Digitalisation of the agri-food value chain,
- Circular Economy and Recycling Technologies,
- Encouraging cross-sectoral synergies and cooperation,
- Enhancing cross-border cooperation among stakeholders,
- Strengthening collaboration with research centers and academia.

Production of value-added products was identified as the most relevant factor, followed by digitalisation (see Figure 19).

Figure 19. Reasons for unexploited opportunities for growth of the Western Balkans agri-food sector



Source: authors

Smart Specialisation recognizes cross-sectoral synergies as a pivotal element in inter-policy connections, addressing contemporary challenges like sustainable development, full digitalisation, environmental concerns, among others. In this context, the advancement of high-tech agricultural production can spur innovation in related fields, notably Key Enabling Technologies (KET) and Information and Communication Technologies (ICT), serving as integral support for future agricultural growth and development.

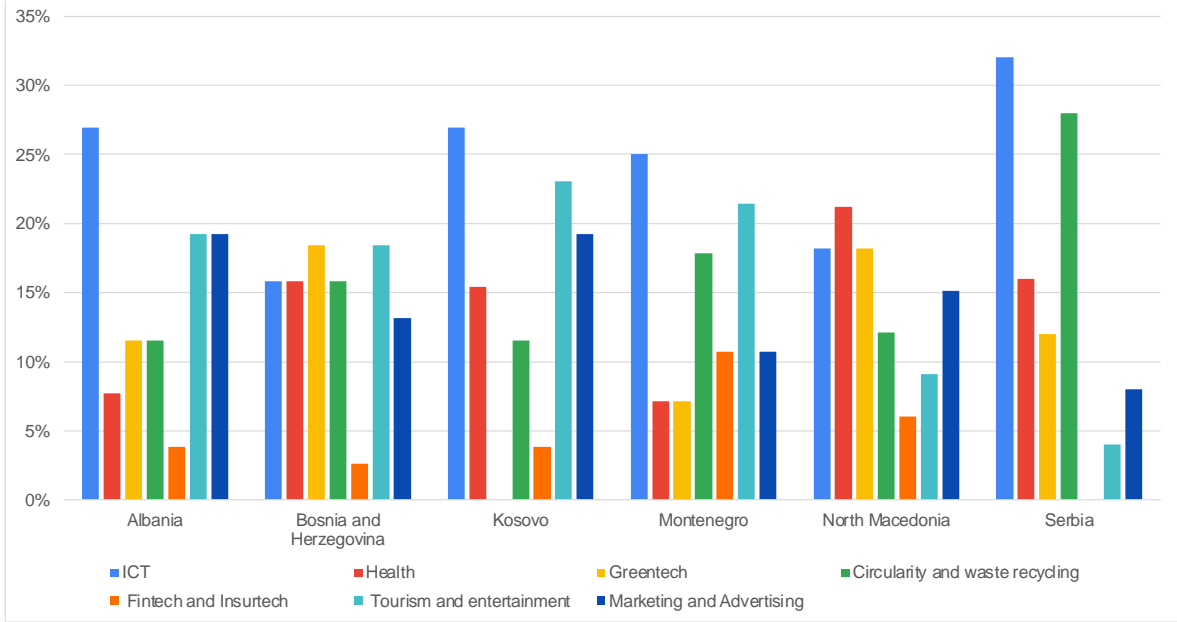
The production of plant material for generating green energy (biomass energy) remains a key focus for both research and industry. Research and cross-sectoral innovations in horizontal priority areas, specifically KETs (nanotechnology, industrial biotechnology, sophisticated machinery, sensor technologies), significantly contribute to the development of value-added food products. ICT solutions (blockchain, IoT, Big Data) play a crucial role in transforming the food industry by enhancing transparency, efficiency, safety, and collaboration across the entire food production chain.

Developing sustainable aspects of the food chain, entailing the reduction of agricultural product and food losses and waste, closely aligns with emerging solutions in ICT and KET domains. The overall conclusion is that the identified sub-areas harbor the critical stakeholder potential needed for successful stakeholder dialogue implementation, presenting untapped development opportunities to explore further within the Smart Specialisation Strategy process.

Traditional food production, primarily led by smaller entities like small farms and handicraft shops, represents a special sub-area with untapped potential that should not be overlooked. This sector possesses significant, yet economically underutilized, potential. Traditional foods, especially when marketed within tourism offerings via rural and other forms of tourism, gain value. Collaborations with the ICT, Creative Industries, and Renewable Energy sectors could substantially enhance the sector's competitive advantage.

As per the online survey designed for this document, respondents expressed positive views on the cross-cutting potential within the agri-food domain. ICT was rated as having the highest relevance in contributing to the sector's growth, as expected. Comprehensive results are detailed in the following figure.

Figure 20. Relevance of synergies with other areas for productivity and growth of the agri-food area in the Western Balkans



Source: authors

6 SWOT analysis

The SWOT analysis consolidates the shared characteristics of the agri-food sector within the Western Balkan economies. It serves as a foundational step to identify areas for potential improvement and highlights significant subjects relevant to research and development, cooperation, and cross-sectoral connections. This analysis was formulated based on conclusions drawn from an extensive review of existing literature and survey results collected from stakeholders.

STRENGTHS:

- Soil and climatic conditions for the agri-food primary sector:
 - Preserved land and favourable conditions for production.
 - Richness in water resources for irrigation.
 - Diversity of agro-ecological conditions across regions is suitable for the production of a wide range of products.
 - Richness of biodiversity (numerous autochthonous plant and animal species suitable for agricultural cultivation).
- Production systems:
 - Short food delivery channels to the consumers (local consumption).
 - Enhancement of competitiveness in some sectors of agriculture (wine, berries, fish, vegetables).
 - Great potential for diversification in rural areas (e.g., tourism).
- Cultural and social aspects:
 - Preservation of traditional production (knowledge, consumer culture, etc.).
 - Relatively high percentage of rural population.
 - Rich rural heritage.
- Innovation potential:
 - Existing structural, educational, scientific research basics.
- Market assessment:
 - Price competitive labour force.
 - Comparative advantages for certain products (e.g., organic products, honey, berries, fish, wine, water, traditional products, medicinal & aromatic plants).

WEAKNESSES:

- Production systems:
 - Structural shortcomings and disadvantages in production and technology in the agri-food sector that led to low yields, low value, and unstandardized production.
 - Insufficient cooperation between the main actors in the sector.
 - High production costs due to the high share of imported raw materials.
 - Insufficiently developed control system in the production chain.
 - Poor and inadequate organisation of farmers (lack of functionality and inefficiency of cooperatives and associations of farmers).
 - Lack of labour force (for harvesting and other seasonal works).
 - Weak infrastructure in most rural areas.

- Fragmented production capacity and sub-optimal industry clusters and other business association arrangements.
- Cultural and social aspects:
 - Aging of active labour force and depopulation of rural areas.
 - Poor rural and insufficiently developed market infrastructure.
 - Low level of farmers' knowledge about technologies, marketing and management.
 - Migrations of working and educated population from rural areas.
 - Low purchasing power of the population.
- Innovation potential:
 - Lack of information, know-how and knowledge transfer hamper modernisation and innovation in the sector.
 - Insufficiently utilised "from farm to fork" approach.
 - Under-utilised potential for inter-sectoral cooperation.
- Market assessment:
 - Weak international market penetration.
 - Low added value of most agricultural products.
 - Poor image of agriculture as a line of business.
- Financing conditions:
 - Lack of own capital of agricultural producers.
 - Unfavourable conditions of external financing.

OPPORTUNITIES:

- Soil and climatic conditions for the agri-food primary sector:
 - Favourable conditions for organic production (low level of usage of mineral fertilizers).
 - Optimising the utilization of agricultural land.
- Production systems:
 - Favourable conditions for organic production (low level of usage of mineral fertilizers).
 - Growing young manufacturing industry.
- Cultural and social aspects:
 - Improving business environment and education, knowledge-transfer and cooperation can increase viability of the agri-sector and attract young professional farmers.
 - Substantial interest for rural tourism.
 - Development of local strategies and rural development projects.
 - Networking of local communities/regions and exchange of good practices with EU regions/local communities.
- Innovation potential:
 - Application of new technologies, innovations and digitalisation for increasing productivity.
- Market assessment:
 - New markets, new products development and recognition.

- Growing tourism offers the opportunity for absorption of seasonal surpluses and the placement of exclusive domestic products.
- Development and promotion of more niche market, higher value agriculture products.
- Growing market demand for organic products.
- Opportunities for branding and protection of indigenous, typical and regional products.
- Increase in quality standards and sales of locally produced food (import substitution).
- Stronger market-orientation of agricultural producers.
- Increasing demand of traditional, autochthonous products and products with geographical indication.
- Financing and regulatory conditions:
 - Accelerated process of transposition of EU regulations in food production and trade.
 - CEFTA and other trade and preferential trade agreements.
 - EU funding programmes.
 - Strengthening public-private partnerships in the implementation of investment programmes and in the governance process.

THREATS:

- Soil and climatic conditions for the agri-food primary sector:
 - Climate change.
- Production systems:
 - Increase in energy and raw materials price (e.g., fertilizers);
 - Diminishing workforce.
- Cultural and social aspects:
 - Increasing rural-urban migration, aging rural households and loss of young, educated population.
 - Uneven regional development.
- Innovation potential:
 - Technological-production related challenges arising from urbanization and climate change.
- Market assessment:
 - Growing market competition and shifting global trends.
 - Strengthening and monopolizing of the large retail chains.
 - Low level of protection of local production.
 - 'Grey economy'.
 - Instability of input prices.
- Financing and regulatory conditions:
 - Lack of strategic planning and effective public policy implementation.
 - Insufficient support from the financial sector to the family farms.
 - Lack of foreign direct investments and inability to secure sources of financing for new investments.
 - Lack of continuity in implementing incentive policies and strategies.

7 Conclusions and recommendations

The Western Balkan region exhibits significant economic diversity among its economies: Albania, Bosnia and Herzegovina, Kosovo, North Macedonia, Montenegro and Serbia. These economies vary in their economic strengths and innovation potentials, particularly in their integration into transnational innovation ecosystems and value chains. However, certain priority areas, such as enhancing renewable energy sources in farming, emerge as common objectives across several regional economies. Such initiatives can foster interregional and international cooperation among the economies, contributing to a green recovery in the Western Balkan region.

While the agri-food sector generates a substantial number of jobs, it has yet to realize its full potential and achieve notable developmental momentum. Actors at various levels of the value chain within the agri-food sector of the Western Balkan economies possess untapped potential for further development and enhanced interconnections, primarily through modernizing business processes. This pertains especially to small agricultural households, smallholders, and medium-sized farmers, who dominate the sector but lack the capacity and financial resources to attain the requisite quality levels for their products. Additionally, fierce competition among these entities affects their inclusion in the value chain, with their prospects improving based on their abilities to meet the needs of fewer processing companies.

The future evolution of the agri-food value chain should prioritize integrating national, regional, and global objectives within this sector. This involves coordinating agricultural development with industry, services, and environmental preservation. The objective is to achieve greater productivity with fewer resources, adopting advanced technologies, leveraging higher capital and knowledge intensities, and capitalising on economies of scale while supporting and enhancing the livelihoods of small-scale and family farmers.

The overarching strategy for the agri-food value chain should emphasize delivering premium products over inexpensive ones, a principle applicable to every economy in the region. The Western Balkan economies have the potential to offer high-quality, environmentally conscious products that can compete favourably even with relatively higher price points. The ongoing trend toward green transition augurs well in increasing the demand for these product types in the coming years.

7.1 Increasing the capacities for innovation and technological development

High-tech agriculture demands new resources to drive innovation across various related sectors, encompassing seed and crop production, mineral and microbiological fertilizer manufacturing, physical infrastructure production (such as poles, nets, and irrigation systems), measurement and control equipment creation (including sensors, data storage facilities, and information systems for data collection, processing, and management), growth regulators, biological and chemical agents for pest and disease control, valorisation of agricultural waste, packaging production, logistics systems, and more. Deep tech, including molecular genetics, biotech, smart machinery, logistics, and ICT solutions like sensors, Internet of Things (IoT), geolocation, satellites, drones, robotics, artificial intelligence, and numerous other innovative technologies, supplements conventional plant and animal production.

Both the public and private sectors need to further engage in creating an environment conducive to research and innovation that aligns with their needs. Promoting effective innovation ecosystems should commence by enhancing national research and innovation infrastructure through the establishment of science and technology parks. Initiatives targeting companies to enhance their propensity for patenting and foster a culture of technology transfer represent positive steps in this domain.

Under these objectives, the following list comprises actions that could be considered for introducing or modifying policy instruments in the agri-food sector:

- Hosting matchmaking events to facilitate interaction among all stakeholders in the value chain, providing platforms for matching technological offerings with technological demands.
- Boosting innovative activities through direct financial support programmes in the form of innovation grants, featuring co-financing, which will incentivize business sector investments in innovation, bolstering their international competitiveness. Examples of such actions aimed at funding agri-food initiatives include the EIT Food Public Engagement Proof of Concepts call for proposals in 2023, 2024, and 2025, along with the EIT Food Innovation call for proposals in 2023.

- Establishing a robust network of sectoral clusters based on Smart Specialisation strategies of each region, fostering collaborative programmes between regional clusters and various sectors. This could draw on insights from the Horizon 2020 INNOSUP programme, utilizing annual calls for proposals on 'Cluster-facilitated projects for new value chains.' This initiative aimed to provide innovation support to SMEs through intermediaries, enhancing SMEs' capabilities to create new industrial value chains promoting the development of emerging industries in Europe, employing a cross-sectoral and cross-border approach. Supported SMEs expressed satisfaction with the transnational component of the initiative, and policymakers, intermediaries, and SMEs acknowledged it as a significant added value. The programme's flexibility in allowing consortia to design projects and combine different support mechanisms for SMEs was another highlight.
- Offering tax incentives for research and innovation investments and providing favourable customs treatment for equipment and materials intended for research.
- Leveraging the capacity of technology transfer offices to facilitate knowledge exchange between academia and industry, promoting innovative solutions to support the development and commercialization of new technologies.
- Implementing support programmes for intellectual property protection to incentivize patenting activity in the agri-food sector, including government incentives.
- Establishing high-tech acceleration programmes to incubate new high-tech start-ups and spin-off companies, offering advisory services, mentoring, networking, and training to support innovative entrepreneurship.
- Developing broadband internet and introducing e-government services, including an open data initiative, to foster digital entrepreneurship and bridge the digital divide.

7.2 Strengthening human resources in the field of research and innovation

Employment programmes designed for PhD students, holders of PhD degrees, and postdoctoral students in the agri-food sector, particularly within the business domain, could stimulate knowledge transfer and facilitate the acquisition of practical expertise. Such a focus would bolster enterprises' innovation capabilities, fostering the advancement of research within the business sector and contributing to the dynamic growth of a knowledge-based economy.

This objective can be realized through the implementation of policy measures that encompass the following actions:

- Implementation of national programmes dedicated to fostering scientific careers tailored to local industrial challenges.
- Encouraging participation in EU programmes facilitating knowledge exchange and staff mobility (such as COST actions, Horizon Europe's Marie Curie Actions, COSME, EUREKA and ERASMUS+).
- Establishment of a network of national contact points equipped to handle challenges, priorities, and prerequisites for successful engagement in European research-related programmes (e.g., Horizon Europe).
- Promotion of researchers from Western Balkan economies to actively engage in the European Research Area (ERA).
- Encouragement of investments in enhancing existing research infrastructure and the establishment of new facilities, along with the procurement of necessary equipment to meet cutting-edge technological standards.
- Advocacy for open access practices by implementing policies supporting access to scientific research literature, international publications, scientific databases, and research-academic networks.

7.3 Increasing productivity by modernisation and digitalisation

Enhancing general digital literacy within the sector is essential for a successful transition. Proposed activities for inclusion in the policy mix in the agri-food domain include:

- Facilitating collaborations between industry and academia to enhance the digital knowledge and skills of farmers and other stakeholders in the sector.
- Establishing specialized training programmes in digital technologies tailored for farmers.
- Developing a comprehensive database of digital resources to facilitate farmers' easy access to these services.
- Initiating funding programmes dedicated to the digitalisation of the agri-food sector.

7.4 Enhancing the integration of local agri-food value chains into global value chains

This recommendation represents one of the most significant opportunities to transition Western Balkan economies from being exporters of basic agricultural products to exporters of processed food and finished goods. It necessitates a structural transformation within the agricultural and food sector, shifting the focus from agriculture to food processing. This shift holds greater potential for augmenting value addition to the economy and boosting exports.

Simultaneously, to integrate into Global Value Chains (GVCs), promoting sustainability practices within the sector becomes imperative. Implementing manufacturing practices, procedures, and technologies throughout the entire production and processing chain is crucial to ensure competitiveness in the market without compromising the natural resources vital for agricultural production.

Some sustainability practices that could be advocated in the agri-food sector in Western Balkan economies include:

- Reducing losses and waste of agricultural and food products throughout the production, storage, processing, distribution, and consumption chain.
- Encouraging sustainable food production that maximizes the utilization of agricultural products, minimizing waste through recovery and reuse of all nutrients.
- Preserving soil fertility for future production by reducing the use of mineral fertilizers and pesticides. This involves promoting the use of biological and organic fertilizers, employing biological pest control measures, utilizing biostimulators, practicing crop rotation, and avoiding monoculture.

Furthermore, to effectively integrate into GVCs, Western Balkan economies would need to enhance infrastructure, labor skills, and deepen trade agreements. The findings indicate that by bolstering GVC connections, these economies could potentially elevate their GDP levels by 3–10%. Achieving this could involve implementing several measures, such as:

- Attracting foreign investment to the Western Balkan region by encouraging the formation of investor communities for innovative companies in the agri-food sector, supporting and training local businesses to access private finance, establishing governmental services to guide foreign investors entering the region, and creating an appealing financial and regulatory environment for foreign investors.
- Developing regional integration links to enhance local GVC networks by intensifying efforts to eliminate non-tariff trade barriers imposed by Western Balkan economies on imports, supporting the adoption of modern and eco-friendly production technology, designing specialized financing schemes for the industry like favourable loans or loan guarantee schemes, introducing new premium products and brands, improving formal education (both secondary and tertiary) and offering new publicly provided programmes for professional education in this sector, providing direct support to producers and firms to meet quality standards required in EU countries, investing in agricultural infrastructure (such as irrigation and sewage), and fostering networking between producers through the establishment of sectoral clusters to enhance cooperation among them.

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List of abbreviations and definitions

CEFTA	Central European Free Trade Agreement
ERA	European Research Area
EU	European Union
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GI	Glycaemic Index
GMO	Genetically Modified Organism
GVC	Global Value Chains
ICT	Information and Communication Technology
IOT	Internet of Things
IPR	Intellectual Property Rights
KET	Key Enabling Technologies
R&D	Research and Development
S3	Smart Specialisation Strategy
SPA	Sustainable Precision Agriculture
STP	Science and Technology Park
TTO	Technology Transfer Office
ULO	Ultra-Low Oxygen
VAT	Value-Added Tax
WB	Western Balkans

List of figures

Figure 1. Value added shares of the agri-food sector	6
Figure 2. Patent network in the agri-food sector in the Western Balkans	9
Figure 3. Scientific publications in the agri-food sector, 2008-2020	10
Figure 4. Scientific publications per capita in the agri-food sector, 2008-2020	10
Figure 5. EU research and innovation funding 2007-2020	12
Figure 6. Type of respondents to the survey	24
Figure 7. Size of the respondents to the survey	24
Figure 8. Type of entities per Western Balkan economy	25
Figure 9. Breakdown of respondents by value chain segment	25
Figure 10. Share of companies that introduced new or significantly improved technology in the last five years	26
Figure 11. Proportion of companies granted patent protection within the past five years	26
Figure 12. Share of companies that plan to invest into technologies in the next three years	27
Figure 13. Factors impeding innovation activities in the Western Balkans	27
Figure 14. Structure of partners in R&D collaborative activities among respondents	28
Figure 15. Geographical distribution of R&D collaborations among respondents	28
Figure 16. Collaboration in EU-funded programmes of the Western Balkans entities, 2017-2022	29
Figure 17. Sources of financing for innovation in the agri-food area in the Western Balkans	29
Figure 18. Most relevant factors of productivity growth of the Western Balkans agri-food sector.....	30
Figure 19. Reasons for unexploited opportunities for growth of the Western Balkans agri-food sector	30
Figure 20. Relevance of synergies with other areas for productivity and growth of the agri-food area in the Western Balkans	31

List of tables

Table 1. Analysis of the impact of IPARD funds for the agri-food sector in Western Balkan economies 14

Table 2. Analysis of the participation of entities from the Western Balkan economies in the H2020 framework programme 19

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